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SUMMARY

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Archimedes' Theory of the Lever

It is well known that one of the landmarks in the history of mechanics is ARCHIMEDES' theory of the lever. In this theory he assumes as self-evident the proposition that equal weights attached at the ends of an equal-arm lever will maintain it in equilibrium. From this proposition, which is the principle of the lever for equal arms, he deduces the more general principle for unequal arms.

In his history of mechanics MACH has given a classical discussion of ARCHIMEDES' theory. MACH argues that the principle of the lever for equal arms is not a self-evident principle, but an induction from experience. It is the purpose of the present note to indicate the elements of correctness and incorrectness in MACH's criticism.

I open the discussion with the remark that if the restricted principle of the lever is to be interpreted as an induction from experience, one would need an independent definition of the concept of equality in weight of two bodies. Now MACH's criticism is fundamentally inadequate because he does not base his analysis upon a prior explicit definition of weight. One can not ask the question, will two equal weights maintain the equal-arm lever in equilibrium? until one has some definition which enables one to decide whether or not two weights are equal.

In the opinion of the writer the standpoint of ARCHIMEDES requires the interpretation that the restricted principle of the lever constitutes a definition of equality in weight. By definition, two bodies are equal in weight if they maintain an equal-arm lever in equilibrium. Now the modern logic of deductive systems has transformed self-evident axioms into postulates which thereby define the characters of the elements and relations referred to in the postulates. From the mathematical point of view ARCHIMEDES' theory of the lever is a deductive theory for a restricted field of mechanics. It is therefore in accordance with modern

logic to interpret ARCHIMEDES' restricted principle of the lever as a postulate which defines the concept of equality in weight.

There is an element of correctness in MACH's discussion, however. The choice of the definition is guided by empirical considerations. If two bodies maintain a particular equal-arm lever in equilibrium, then the same bodies will maintain all levers in equilibrium, regardless of the time and of the position, length, material, color, temperature of the lever. Thus the relation between two bodies which maintain a lever in equilibrium is a universal character which exhibits itself in a multitude of particular instances. The relation is symmetrical and transitive and is therefore to be interpreted as manifesting the possession of a common property. This common property is a specific magnitude of weight. Thus the empirical generalization that equal-arm levers behave similarly under the action of two given bodies is a justification for the definition of equality of weight in terms of the restricted principle of the lever.

From the physical point of view the restricted principle is a definition of equality in weight, which concept is useful because of its generality of application. From the standpoint of deductive theory, however, a postulate expresses certain properties of the fundamental concepts of the theory. From this point of view the restricted principle of the lever is a postulate for a deductive theory of the lever. Thus, on interpreting ARCHIMEDES' theory in the light of the modern theory of deductive systems, his restricted principle is seen to be an essential element in the foundations of a deductive theory, an element which from the mathematical point of view is to be assumed at the outset, since it constitutes a definition of a fundamental concept of the theory.

University of California,
Berkeley.

V. F. LENZEN.

Observations on the Fly of Rosebushes and other Insects of the Same Habitat

BY

ANTONIO VALLISNIERI
TRANSLATED BY MAB BIGELOW
AND REVISED BY R. P. BIGELOW

Preface to the Translation

There are some minds that stop short at what they first perceive, others that continue to observe phenomena to make deductions, and arrive at conclusions. When, however, imagination is very active the observer may tire of the monotony of incessant, repetitive study, and after establishing a certain number of proofs leave other cases unfinished, or divert the evidence to a fantastic end, and « sin against philosophy », or logic.

Something of this kind may account for the strange suspension of judgment in REDI's observations, where in his experiment with the larvae in the oak-gall, he attributes their death in the gall to the fact that it was detached from the tree, and thus deprived of contact with the vital force inherent in the living plant. Such an admission exposed him to the sarcastic criticism of VALLISNIERI, a physician also, but of a later, and more sceptical time, who boasts of « our Century of Science », the eighteenth, and writes condescendingly of the efforts to combat the theory of spontaneous generation in the seventeenth century. In fact he repeats REDI's oak-gall experiment, and shows why it failed in his treatise on the garden rose sawfly, which was selected for the translation that follows to serve as a sequel to the Experiments on the Generation of Insects by FRANCESCO REDI, previously translated. (1)

(1) Chicago : Open Court Publishing Co. 1909.

ANTONIO VALLISNIERI was born May 3rd, 1661, at Trasilico in the Duchy of Modena, and died at Padua January 28, 1730. He came of an old family of Reggio; studied at Scandiano, Modena, and Reggio; and after studies in medicine, at Bologna in 1683 under SALANI and MALPIGHI, he was admitted to the degrees of Doctor of Philosophy and Doctor of Medicine at Reggio. For further study he visited Bologna, Venice, and Parma before beginning the practice of medicine in Scandiano. In 1700 the Republic of Venice invited him to take the chair of extraordinary Professor of Medicine at Padua, and in 1711 he was advanced to the position of principal Professor of Theoretical Medicine, which he filled for the rest of his life.

He was an active investigator in embryology, entomology, parasitology, and botany. In embryology he was an ovist, and made several attacks on the animalculists. He was a frequent contributor to the « Galleria di Minerva » 1700-1710, in addition to numerous works published separately.

His contemporary fame is shown by membership in the Royal Society of London and in the K. Leopoldinische Deutsche Akademie der Naturforscher; and by invitations from the Pope to be his private physician and from Turin to fill the chair of medicine in that university. These offers were both declined. A medal struck in his honor in 1727 from a design by F. SELVI shows his portrait in profile with full wig, and on the reverse is a scene symbolic of his work with the motto :

Tantum in modicis quantum in maximis

The Garden-rose Sawfly was discovered by VALLISNIERI, whose very accurate description of its structure and life-cycle is recorded in the letter translated below, which was published as part of a book entitled,— Esperienze, / ed / Osservazioni / intorno all'Origine, Sviluppi, e costumi di / varj Insetti, con altre spettanti alla / Naturale, e Medica Storia, / fatte da / Antonio Vallisnieri / Pubblico Professore Primario di Medicina Teorica / nell' Università di Padoa, / e Consacrate / All' Illustrissimo, ed Eccellentissimo Sig. / Gio : Francesco / Morosini / Cavalier di S. Marco, / e Riformatore della suddetta Università. / In Padoa, MDCCXIII. / Nella Stamperia del Seminario, appresso Gio : Manfrè, / Con licenza de' Superiori, & Privilegio. / (10) + 232 pp., 13 pls, 8vo.

The chapter on the sawfly occupies pages 1 to 82, and is dedicated « All' Illustriss. Signor Lorenzo Patarol, ec. » This chapter is divided into three parts, listed in the table of contents of the volume as follows :

« I. Osservazioni intorno alla Mosca de' Rosai, e d' altri Insetti, che annidano ne'medesimi. pag. 1

II. Riflessioni sopra la maniera sinora creduta del nascere degl' Insetti. pag. 33

III. Idea nuova della division generale degl' Insetti. pag. 40 »

It is illustrated by three plates.

The translation covers all of Sections I and II, with some omissions, and the last three paragraphs only of Section III, followed by the explanation of the plates. Section III has been omitted because it is a digression on the classification of insects, foreign to the main theme of the chapter,—the question of spontaneous generation.

In this chapter VALLISNIERI treats of four species of sawflies. Mr. S. A. ROHWER, formerly Specialist in Forest Hymenoptera, and now Assistant Chief of the United States Bureau of Entomology, has been so kind as to read the translation in comparison with the original, and reported on the identity of these species, under date September 19, 1917, as follows :

« The garden-rose sawfly first, and extensively, treated with surprising accuracy is without much doubt *Arge pagana* (Panzer).

The similar sylvan rose sawfly next treated is probably *Arge enodis* (Linnaeus).

The sawfly which deposits its eggs in the midrib and is figured on Plate 1, fig. 17, is without much doubt *Cladius pictinicornis* (Fourcroy).

The account of the « garden fly » which lives within the stem seems to be somewhat confused, but the description of the larva might be that of the prepupa of *Emphytus cinctus* (Linnaeus). »

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OBSERVATIONS ON THE FLY OF ROSEBUSHES, ***

To the most illustrious Signor LORENZO PATAROL, etc.

While you, most learned Sir, are cultivating beautiful plants and flowers in your delightful garden, I find recreation in my own little plot, by watching the habits of one of the most ingenious insects created by the Great Maker of the Universe. This pleasant and instructive occupation, though of no weighty import, and far from bringing the dazzling results of more brilliant experiments, seems nevertheless to be about to shed no mean light on the dull endeavors of the Schools, if, as I hope, true philosophers may not be ashamed of learning more truth from a fly itself, than from what has been written about such natural phenomena by their ancient masters; a little thing can, as LUCRETIUS says :

« Give an example, and point the way. »

On the sixth of May a fine garden fly, that I have already mentioned in one of my Dialogues (2), flew over a rosebush. Having lit on the most tender part of a young shoot, it soon after thrust out of the lower belly a hooked sting, that it inserted into the branch, thus remaining for a short time; then, having taken firm hold with its feet, it began to raise and lower itself, and alternately swelling, and drawing in the abdomen, it appeared to be making efforts to expel something from itself. This done it became quiet, and then like the countryman, who cuts the earth with the plough to throw in corn, the fly continued to furrow the twig in order to place its seed therein. When tired it frequently rested, then returned to the task, working ahead and dragging itself along with signs of fatigue, as if panting from excessive labour, for this female fly quite alone had to split the branch to make places for the eggs that she laid, and arrange them in wonderful order, being thus at the same time servant, mistress, parturient, and midwife. So absorbed was she in this affair that she not only paid no attention to me, but remained attached to the branch even after it was cut off, and carried into the house for examination and description. See Plate 1, figures 1, 2, 3.

I observed that the cut in the twig was spread with a slimy

(2) Dialog. I. Gall. di Min. Part X, pag. 316.

and viscous juice run out after the eggs to prevent the open lips of the slit from joining and closing. All flies, that spoil or rip the buds and bark of trees, act in this way, and from the different kinds of fluid emitted with the eggs arise, I think, the various kinds of galls, lumps, tubercles, tumours, husks, berries, glands, knobs, sponges or similar growths that we see every day on oaks, poplars, elms, on cultivated but especially on wild rosebushes, on willows, ground ivy, dog's grass, barberry bush, briers, osier, beeches, and on hundreds of other plants. For this fluid according to its nature changes the nutritive sap, twists and curls up the veins, and makes the tissue grow crooked, and take on that shape peculiarly induced by such a violent alien ferment. This injected liquid has not always the power of destroying the internal structure, for other kinds have been observed to be much milder in effect, merely preventing the conjuncture of the edges of the slit, and this is the case with our flies. Their only need is that their eggs be placed in that niche as in a brooder, that they absorb until birth, as much nourishment as is necessary to keep them soft and to nourish internally the future little worm (vermicello), which as soon as born, leaves the nest, and crawls on the tender foliage of the rosebush to feed. But the worms (vermi) of galls, burrs, and such remain burrowed in until perfect maturity, that is until capable of flying, hence it was necessary that in their case the accompanying fluid should not only prevent a scar from forming over the separated parts, but should injure the tissue so that an alimentary juice might constantly percolate.

Having broken the branch across where the cut was made to see how deep the eggs were, I found them inserted exactly as far as the length of the sting. As you can see in Plate 1, fig. 4, which, however, with the growth of the branch, and the enlargement of the mouth of the wound, become exposed on their upper side, as you will see in Plate 1, fig. 5, 6, in which appears the dilation of the cut after a few and after many days.

I must not neglect to tell you that these flies usually split branches to the north of the bush, or in the shadiest and coolest spot to avoid the sun baking, that would cook them, and harden the wound that is vital to them.

The number of eggs laid is not always the same, sometimes I have counted up to twenty-eight, sometimes eighteen, but

usually about sixteen. These at first do not exceed the size of a mustard seed, but they grow in proportion to the nutritive sap absorbed, and to the enlargement of the internal embryo. Seen with the naked eye they are oval, but the microscope shows them to be less on one side like beans, or the testicles of a cock. Pl. 1. fig. 8 & 7. They are of dull yellow, and are placed on the branch divided in two rows. Pl. 1. fig. 6. They are mortised obliquely, every egg being separate from the other, and placed in its own socket. Wonderful artifice. Without using mouth or feet, but by means of a blind tool placed at the rear of the belly, the fly digs a little hole for each egg, and leaves it separated from its neighbour by a dividing wall crosswise, another lengthwise making two rows.

Meanwhile I had found other eggs (uova) similar to these, encased in green branches, and daily paid attention to their growth and changes, all of which I permit myself to relate freely, though it be as tedious to read as to observe minute details. After a few days the eggs (uova) appear much larger with such a transparent shell, that the increase in size of the internal worm is observed. On the 13th of May I began to make out with a lens a little, white, cloudy mass with threads or lateral ramifications, which is usually called carina by anatomists owing to its resemblance to the keel of a ship. This was the spinal cord with the head, or the first outline of the whole body somewhat condensed.

On the 15th of the said month I saw two black spots in the region of the head, which was turned in and toward the upper side of the egg.

On the 16th the cloudy mass increased and these points appeared to be eyes, and the mouth was seen turned upwards.

On the 17th day the internal visceral organs were apparent, the small hooks or forceps of the mouth had a light brown colour, and were serrated with three teeth each. On the upper part of the body, I saw three black spots together on each side, which were the forefeet, moving visibly as did also the little mouth forceps. Such motion is common to the fetuses of larger animals in the uterus of the mothers. I also seemed to see the umbilical vessel in the belly.

On the 20th day three little worms (vermicelli) were born,

leaving the casts or eggshells in their cases, which were pierced at the point where I had seen the forceps of the mouth.

The worm (verme) as soon as born stops in motionless astonishment on the edge of its little cell, until the air hardens its body, and gives consistency to the tender softness of its parts. It seems longer but thinner than the egg (uovo), the head is transparent and tinged with brilliant black, as are also the six anterior feet, which are very much longer than the others. The whole head is white and diaphanous, covered with a few coarse hairs, and spotted with black, except the dorsum. The air spiracles, or rather the orifices for breathing, are visible opening laterally; the last ring is ended by a dark appendage spiked with several bristles.

On the morning of the 21st all the larvae were born, and in the afternoon left their old nest, and wandered about in search of food. One placed itself immediately astride the edge of a fresh, tender leaf, and began to devour it voraciously after the manner of silkworms.

On the 22nd, they looked greenish on account of the green food swallowed, that showed through the diaphanous little body. When they eat, they usually curve up the hinder part as the scorpions do with their threatening tail. Which you see Plate 1. fig. 9. On the 25th day their growth had not progressed owing to the chilly air, but they seemed more swollen, and the feces now showed black in the lower belly. On following days until the end of the month, they ate greedily, and then became quiet as if oppressed by lethargy; after a period of this they shed the first skin called « senecta » by the Latins. They were quite white with the exception of two dark little balls which swelled out on the right and left side of the head. After taking food the head turned a honey colour and the body green; then after a few days, the first became all black and the second spotted with black.

In this way they continued to feed, and after growing larger, and shedding their skins several times, as all caterpillars do, they reached their destined size, when their structure was easily seen without a glass, as I shall describe briefly : over the head rise two very short, flexible horns called most appropriately « ignava cornicula » by the Latins, as they are not fit for fighting,

nor for grasping, and by the Italians « antennae » on account of their likeness to those spars of ships to which sails are attached. From the under part below the chin protrude four pliable antennules by some called in Latin « processus », but not defined by the Italians at all, so far as I know, although almost every minute animal is supplied with them; two of which are longer, and their use has not been observed by many. I however suspect them to be instruments of touch, for in walking or eating these are always thrust forward to feel different objects met with. The larger antennae of the head serve the same purpose I believe, as in the case of snails.

Their mouth is covered by a shiny, horny, black plate, not unlike that of lambdoid shape that covers the mouth of the bombex or silkworm, from which the labium proper hangs. The cranium is rounded like that of a man, not crushed or pressed in like that of other caterpillars. The whole body is composed of twelve segments or incisions not counting the last, which ends the lower abdomen. All are crisped up, and as if subdivided into lesser incisions to the number of forty, so that the body appears all wrinkled, and marked with many rings. It is ornamented with black, shiny, round spots with a hair on top of each, resembling the caterpillar that feeds upon the Ebulo. These hairs are disposed in three rows, which extend from both sides to the tail. A little underneath are seen the openings of the lungs also surrounded by a black circle.

In the first rings or segments it has six legs, three on a side, marked by the usual joints, and armed with claws common to every caterpillar. Ten other legs come from the following five rings, excepting the fourth and the last three. The structure of these legs differs from that of ordinary caterpillars, because they are not furnished on the flat with a semicircle of claws, nor broaden out into an obvious palm, but are arranged in a less orderly manner. From the ulterior rings, instead of legs, a slight protuberance takes the place of feet in walking. In all the rings furnished with feet, there rises at their base a certain little hill, like an udder, from which like nipples the short, round leg come out. The extremity of the worm (verme) is finished with a segment spotted black, under which two projections serve as feet. A black, oval shaped dung is extruded from the anus. To see

with your own eyes what I am roughly describing, look at one of these little grubs in Plate 1, fig. 11.

They thus grew to perfect size, being carefully nurtured by me in a box. I thought that they deserved also the name of Caterpillars (Bruchi) called *Erucae* by the Latins, more than that of worms (vermi), although flies come out of them too, because they have analogous features to the others, and might be called in Latin with a made up term « *vermes eruciformes* », in order not to affront the Tuscan purists with a new word, should they be called in the barbarous vulgar : « *Vermi Bruciformi* ».

Having been sufficiently nourished they all withdrew, and hid at the bottom of the box under the leaves and detritus where they built fine, white cocoons of oval shape in which they remained imprisoned. At the end of eighteen days, flies like the parents came out in June. From a single cocoon of which, there came out a winged form (volatile) of different species from the others, a long *Mosca Carnivora*, of whose peculiarities I have already sufficiently treated in my Dialogues, (3) and lately in my Treatise on the origin of ordinary Worms in the human body. (4)

Their cocoon called by the Venetians Galletta, by us Regians Follicello, by the Latins *Folliculus*, is somewhat different in structure from the common cocoon of caterpillars or silkworms, which are only a foreign species of caterpillar that build their prison-house with a finer and more abundant secretion. If you look at the cocoon of our kind of flies with a single lens, you will see a network, somewhat enlarged in Pl. 1, figs. 12 and 13. It is not woven with threads that overlap, but made like a net with a viscous material like gum or glue, of silvery and sometimes yellowish colour. Under this net is another little cocoon, thinner and worked in more masterly fashion like a very fine linen cloth. This is a new fabric of cocoons that I have discovered in nature. Many in my collection look more like nets coarsely worked with mucilage than like cloth. In this kind of cocoon the inhabitant is neither clothed nor naked, and is defenceless against the stings of voracious insects, had it not the wisdom to build its cocoon at the roots of the rosebushes, in light, dusty soil, as I shall subsequently relate.

(3) Primo, e secondo, Gall. di Min. Tom. 1 & 3.
(4) Pag. 11, fino a pag. 14.

On the completion of the cocoon the grub remains quiescent, and becomes shorter; then after a short space of time, the skin cracks along the back, from which opening the creature comes out after a series of wriggling movements, not a caterpillar (bruco) but a nymph, or chrysalis, leaving aside its old vesture it appears as another animal entirely different from what it was. That is to say, it was wrapped as in a sac like a being within a being, eating and drinking with the appliances of the apparent caterpillar (bruco). But the change from one state to another is not a transmutation as some have wrongly believed, it is rather a simple manifestation of what was hidden and enwrapt. In this nymph (5), or second apparition, all the limbs of our fly begin to be seen wrapped as in a very fine tissue. The breast and the black head, the feet, and the antennae are seen turned downwards, and the wing turned over the breast, and crossed over the belly, the whole being swathed and sheathed in its webs. The eyes appear on either side of the head, and on the forehead are three little crystalline globules. The back is wrinkled and wan in hue, and the abdomen is composed of nine rings in which signs of the respiratory organs are visible. See Plate 1, fig. 14, in which is seen a nymph slightly enlarged with the microscope.

In the corner of the cocoon the cast off skin is always found as if carelessly rumpled.

After a few days the back of the nymph begins to crack, and from this opening comes out our fine fly as from a living niche, in which up to that time it has been hidden. Hence you will clearly perceive that this is no metamorphosis, or transmutation of one animal into another, but a detachment, an unfettering of one creature that was enclosed, lived, and grew in the skin of the second, and the second in the skin of the first, as an embryo emprisoned in a double membrane which by degrees develops, and reveals its hidden parts. And now I beg you to stop and reflect a little about this mysterious handiwork of the Creator. Before a worthless fly can arise how much industry, material, and how many favorable circumstances are required. We can only admire, never understand things so minute. When an animal is born of another like in all things to the parent, we think that

(5) *Vid.* the letter of Count ANTONIO ABATE CONTI.

we understand it, though there is difficulty enough here, but it seems to me an extraordinary turn of affairs when an entirely different being is born from an animal, as a worm from a winged form. Is this the work of a Master, who wishes to confound our human pride? Else were it hard to comprehend why the creature was first made a worm, that, self imprisoned, soon tears its old vesture and emerges a fly : a wonder to itself as it gloriously conquers the air or poises on the wing, when so little time ago it was subject to crawl abjectly, and be trampled upon. This beautiful law, I have always found invariable and perpetual, not only in the case of our fly, but in that of all insects; all are destined to go through this bizarre series of changes and developments, as a perfect fly is never born from a fly, nor a scarab from a scarab, nor a cevettone, nor a butterfly from a butterfly. This may be said of all winged, two, four, and sheath winged animals to use our own terms. But always first is born the egg or the worm (verme), and undergoes all the described changes before becoming similar to the parent. To one who understands Nature's miracles, enough has been said, though I would never have believed these things, had I not proved them to be true by repeated experiments. Now let us describe our Fly, and be the first to give a name to this admirable Insect, although so far it has not merited to be recognized by the accredited Schools.

At first sight its structure resembles that of ordinary flies, that buzz about our houses much to our annoyance, see in fig. 1, 2, and 3 of Plate 1, so I have given it the name of fly, though it really deserves another, as it is of a different species, and even of a different genus (genere), entirely different both from the manner of laying eggs, and from the sting in the abdomen of the female, also on account of the manner of feeding and building the cocoon, and other reasons, that I will mention below. I have done this in order not to introduce new names, upsetting established order, and allowing myself to add only the epithet of *rose saw (rosisega)* or *of roses* or *rosebushes*, on account of the fly's habit of sawing the branches of rosebushes longitudinally. All the numerous insects that deposit eggs in the same way, *i.e.* by piercing plants for a suitable nest, should be placed in a separate genus (genere), divided into species according to the different results that each accomplish, thus separating those that make

galls, from those that create tumours, and other queer growths, false fruits, and scabrous, spiny freaks, that « horrify the mind with their multiform shapes ».

All this population of little beasts have a sting at their belly's end, that is neither venomous nor vengeful, like that of wasps, hornets, and bees, but innocent and industrious, destined solely to saw or pierce wood and plants for the purpose of depositing their eggs in the aperture. Second, they all have little pincers about the mouth, not the fistulous proboscis of the common fly. Third, they make the cocoon before becoming nymphs; fourth, they have four wings to the two of the ordinary fly; fifth, they feed on the pure sap of plants or of leaves while in the shape of grubs; sixth, after perfect maturity they fly afield : (6)

« — *Saltus, sylvasque peragrant,*
Purpureosque metunt flores »

Thus acting in the manner of bees rather than flies, which usually delight in all kinds of filth and nauseating garbage, that is as VARRO said of Bees : (7) *Non ut Muscae liguriunt, quod nemo has videt, ut illas, in carie, aut sanguine, aut adipe.* » Hence it would seem to me to be not inappropriate to assign new names, either simple or compound, to newly discovered genera and species, as the ancient Fathers did; and, with great discrimination, the wise Greeks, Nevertheless, with all due deference to the old terms, I retain the common name, being satisfied with giving a hint of my doubts.

The food of our *Mosca Rosisega* is the honeyed juice of flowers. I have noticed, however, in my garden, that they do not fly over all the flowers like bees, but usually hover above parsley, and other aromatic herbs, and I wondered that they did not seek the roses of the hedges. I do not deny, however, that they may seek other flowers for food, but I only tell what I have seen.

These flies are so dull and stupid and almost blind that when they light on a twig, they drowsily allow themselves to be caught without attempting flight. On being touched or irritated they will fly rapidly away either in a straight or an oblique line.

This fly gives a simple and clear idea of the work of all similar

(6) VIRG. 4. Georg.
(7) 3 R. R. 16.

insects, which saw or pierce plants, and illustrates a wonder of the vegetable kingdom : the parturition of alien creatures from its lap, that astonished many worthies of the past century. In this species the organ used may clearly be seen, and the naturalist, without leaving his garden, may observe the laying of the eggs in the wood, and their subsequent development. If some of those too severe and literal philosophers could leave for a while their idolized schools, and solitary studies, and turn their minds to these more minute creations, and would have less confidence in themselves, and more in the opinions of experimental philosophers, they would possibly learn the truth from simple, visual observation. Let the Aristoteleans read their Master aright, and consider his remarks on the generation of bees, to the effect that it is necessary to believe the senses rather than the reason, when one is discovering hidden things. His words should be sculptured in marble over the doors of the Schools :

« ... *Sensui Magis, Quam Rationi Fidendum...* » (8)

Our flies are not larger than the common ones. They are very handsome to look at, for the feet, wings, and head are tinted in bright purple, and the abdomen is all of a pretty dark yellow colour. On either side of the head, two oval protuberances, like a minute gridiron, are usually taken for eyes, between these rise the small antennae, turned backwards and supplied with short hairs. The mouth is covered with a cartilaginous shield, armed with cutting scissors. Under these are two folds. The nasal apertures have some hairs that are called *vibrissi* in perfect animals, and the forehead three shiny globules. The back is curved like a shield cut with fine furrows, and is formed of strong, cartilaginous material. The fly has six distinct legs like other insects, of many articulations, at the end of which are the feet terminated by curved claws. The legs swerve outwards, as some old writers would call *varas*. Two thorns or styles rise from the edge of each articulation, of different size, with which the flies, like other insects, secure a firm hold on plants; from the wind and from attack.

On the right and left of the back, towards the top of the thorax, and under the armpits, so to say, are hung the wings, two on

(8) De Gener. Anim. lib. 3, Cap. X.

a side. The upper ones are longer and broader than the lower. On standing still they cover the whole region of the lower part, crossing at the ends. They are not held spread out as in the case of other flies. They are of a rather diaphanous violet, particularly transparent towards the back, where they are more spread out. They are ribbed with fibres and threads wonderfully arranged with a black spot at the extreme end. See Plate 2, fig. 1.

The abdomen is covered by eight cartilaginous zones of dark yellow, like saffron, very shiny and almost transparent as if made of amber. The last ring above the anus is set with black hairs, and under it is a conic shaped piece of flesh. These zones do not encircle the whole abdomen, but become curved in at the sides where they take on another row of small blades under their round edge. There are five of these curved blades, every one of which laps over the margin of the other like a tile, so that the belly can swell or shrink at will. The first terminates at the thorax, intruding under it, and the last supplies the place for the base of the sting. (9) Observe Plate 2, fig. 2 & 3, where is the last blade, and the end of the lower belly, in which the sting is hidden that I shall presently describe; all parts being, however, enlarged by the microscope. Both the segments and the blades lower down, are united and bound together by a strong and pliable membrane, and furnished with little bundles of muscle fibre and nerve cords so that they may be extended, and retracted according to the movements of the abdomen.

Now, dear Sir, it remains for me to describe the wonderful instrument, with which the fly cuts the branches and drops the eggs. If not for this specific use the sting is not drawn out, but is kept laid down, and hidden in a depression, that is hollowed out in the nether part of the fly, and is raised only for this operation. When it lies supinely in its furrow, the tumid margins close over it laterally imitating in a certain manner the shape of that part of the female body that discreet women would preferably keep concealed and which a great poet praised alluding to Fiammetta. Plate 2, fig. 3, enlarged by the microscope.

This sting is of horny substance curved towards the point and has some similarity with the surgeon's scalpel, called by

(9) Pl. 2, fig. 2 and 3.

the Greeks *Scolomacherion*, by the Latins, *Scalpellum falcatum*, by the Italians with a barbarous and shortened word Gammaut. You may see it in its natural size, fancifully placed on a finger nail, Plate 1, fig. 4.

When the fly is about to begin parturition, and to furrow the branch, she draws her sting out from its hole gradually, and raises it slightly out of the niche. When fully raised the sides of the sting appear to be spiral and serrated, the teeth being placed at proportionate distance, and inclined slightly toward the base, Plate 2, fig. 3. The eye armed with the microscope also sees that the point is divided (bifido) and hollowed from the lower to the upper part, and separated in various moveable parts. See again fig. 3, Plate 2.

In order attentively to observe this marvelous instrument, I removed it from the fly, placing it on glass under a good microscope. Then I began patiently to examine all its parts with the greatest care. The back, or part looking toward the belly, I found to be hollowed by a channel of varied diameter from the base to the point. The greatest width is at the base, afterwards it narrows, but broadens again at the top like the blade of a lance, then it becomes slimmer and ends in a sharp point. Please see Plate 2, fig. 4. Both sides of it are spiral, from the furrow of which seem to come out a bunch (fascio) of teeth inclining down. These spirals are made of certain little cords (funicelle) placed in regular order, inclined toward the inside and to the base. See again Pl. 2, fig. 4.

To remove the least shadow of doubt that this was really a channel, and fearing some illusion of the microscope, I stood the sting on end, stuck to a piece of glass, then I cut it across with very sharp scissors and again examined it perpendicularly through the microscope, and noticed a small but obvious hollow.

Another sting observed from the side clearly showed three things most worthy of note. First, the internal margin had a cutting edge shaped like a saw with teeth serrated, that is made rough by other minute teeth. Second, I discovered other teeth of an entirely different kind, very long, and attached to the lateral walls of the saw, inclined to the base at regular intervals. Third, the back of the sting was covered with spirals of fibres, that swathe it from top to end, and was curved, and made like a snail, owing

to these same fibres or little cords, that encircle it from top to bottom, swathing it, and vortex like, so to say, furrow and compress it. Take note of everything with your keen eyes in Pl. 3, fig. 1, as it is easier to conceive the idea of certain abstruse productions of nature by showing them in figures, rather than by verbal description.

Not being entirely satisfied with the external examination alone, and desiring to understand the hidden structure of this mechanism, I divided the sting with a very sharp pin, and separated it into three parts. Then I could begin to comprehend the complicated work of sawing and cell making at the same time, because I observed that the sting was composed of three parts distinct from each other, though apparently united: that is there were two saws with a fissure between them, which was the channel by which the eggs were brought to the cells, and may be called the external oviduct. Observe these three appliances separately in Pl. 3, fig. 2.

The (10) forward part of this oviduct is deeply hollowed, and open like an exposed canal with lateral banks. It is very wide and cavernous at the base, and is armed on the edges with various stings or styles looking to the point that narrows to the end. In the rear of this there is another minor duct. On examination of another section, I saw both ducts distinctly in Pl. 3, fig. 7, and suspected that the anterior conduit was the one that brought the eggs, and the posterior, the fluid that moistens the wound, and prevents the edges from closing, and suffocating the eggs. Pl. 3, fig. 7. I judged that these supplementary lateral styles acted like valves in impeding the eggs from receding, and in keeping them from leaving the bed of the channel until they were safely in the narrow part, which directly guided them to the cell or alimentary nest. Indeed one day, I succeeded in snatching a fly from her work, and saw an egg ensconced in the said duct. It may be that the rear channel is made to give lightness to the oviduct as it consists merely of membrane, that protrudes on emitting the egg, and at other times is drawn into the interior. The oviduct was strengthened by the aforesaid snail-like bodies,

(10) This paragraph is condensed in translation from two paragraphs in the original (pp. 18 and 19).

that do not aid the saws, though on a general view they appear to be the back of the same. They are the chief cord of the oviduct, and are of a very hard, almost horny substance, more pliable at the joints, so that I understood how the fly could stretch or lengthen her oviduct at will, twisting it to either side in order to deposit the eggs in the right or left cells, aided by these same fibres. It is possible that, as in our intestines the spiral cords aid the peristaltic motion to expel the feces, so these urge on the similar motion of the oviduct to expel the eggs. (11) See an oviduct drawn from the side that I dissected off, in Plate 3, fig. 5.

I turned my attention to the saws, that I had carefully separated from the rest. They appear in Pl. 3, fig. 3. drawn better than I can describe them. Their top is not acute but hooked like a sickle. Every tooth is armed with little teeth, and the intervening distance is also serrate. From which arrangement a smith might learn how to make a particularly biting and efficacious saw, borrowing the model, made by the Master hand of God.

But this is not the only wonderful thing: the rows of teeth on the lateral walls, Pl. 3, fig. 3, that are long and equidistant are another mysterious apparatus, that serves to cut and break up into minute bits all the fibres of the rosewood that they rub against. These are also horny to the base, but here there is a tenacious, flexible membrane attached to the saw, so that the teeth follow every motion of the same, rising, lowering, and turning themselves in every direction. If this were otherwise the teeth would break or hinder the operations of the saw.

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I noticed that this row of lateral teeth is placed in line with the marginal teeth, as is seen in Pl. 3, fig. 4, and there are as many of these rows as of the others all impinging together and correspond in position, helping and completing the work of triturition of all the fibres because they do not unite again. The shape of these teeth is like a thorn, with somewhat obtuse point, or like those

(11) Here the author inserts a description of the intestine of an ostrich which he had dissected. (Omitted in translation).

coarse combs, which we use first to lift, or disentangle the hair. The last ones toward the end are barely visible.

Not all the rows have the same number of teeth, nor are all the teeth of the same length. The first rank consists of four only, the 2nd of eight, of which number are the 3rd, 4th, 5th, up to the 9th, when the number is again four.

As well on one side as the other of these saws there is this ordered thicket of teeth, in such a way that in motion, they may easily with point, and with cutting edge, straight and across, cut and triturate the fibres of the rosebush branch.

I observed in a living fly, that these saws move alternately; when one rises the other is lowered, and *vice versa*.

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I noticed the same arrangement of organs in the sting of a wild fly, that punctures the branches of sylvan rosebushes, called by some *cynosbatos*, or *cynorrhodon*; which with the same order and industry hides her eggs in them, and I have drawn it in Pl. 3, fig. 4, and the fly is placed in Pl. 1, fig. 3.

It is proper, that I should at the same time indicate to you how that the sting drawn in profile in fig. 1, Pl. 3, and the appliance of the saw, fig. 3 of the same plate, are not entirely perfected to their base, being somewhat lacking; but only that of fig. 4 of said plate, is entire, while the principal and greater teeth, that are in the internal margin, are twelve without the hooked point, and the rows of thorns are of the same number, or moveable lateral teeth, counting the last two minute ones toward the point.

In fig. 5, Pl. 3, you will see the side of the median tube, that I called oviduct, separate, and free from the saws already mentioned; and in fig. 6, same plate, you will find a sting of a wild rose-sawfly, seen from the front, the median canal being somewhat open, and on which I purposely ruffed up the teeth, or stiles, so that their moveability might be noticed together with position, method of operation, and varied length.

But we have spoken at great length of this wonderful sting though not sufficiently as to exhaust the subject, which is worthy of more extended research, and deeper reflection. But for the present I am content with having discovered, and presented it to the consideration of the World of Letters. May it be studied

and discussed by more exalted minds, in a manner worthy of the subject.

If our fly be taken, and gently stroked with the fingers on its abdomen, the sting comes out suddenly, and at the same time there emerges from the hind part a shiny tuberous bladder, that has a diastolic and systolic movement.

The male lacks this sting, which would be a useless burden to him. The extreme end is closed with cartilaginous scales seen in semicircle, and by little membranous sacs, that hold the organ of generation. When the abdomen is compressed it does not come out as the male member comes out instantly in the case of the male of the common fly. Two processes in the form of styles are seen only, but not the usual single member of generation. The male is slightly smaller in body than the female, which is proper to all insects, as even Aristotle mentioned in his book on animals. Plate 1, fig. 16.

You probably would like to have an explanation of the reason why some kind of growth or gall does not arise from the wound inflicted by the sawfly, but please remember what I said at the beginning of this letter, that different results occur, and various tumours, or diverse perversions arise according to the nature of the juice that flows out after the eggs.

* * *

In the case of our fly, the fluid is viscous, and perhaps of a balsamic character, hence there follows a partial closing of the canals or little sacs carrying the nutritive liquor, and no fermentation or disturbance ensues; this fluid binds as it were the sawn parts, and acts like a mild poultice in preventing them from becoming ulcerated or gangrenous, so to say, allowing the sides to sweat a few drops of alimentary substance sufficient to nourish the little fetus in the egg. Though we may not wish to say that, mixed with the sweet nourishing juice of the rosebranch, it penetrates through the pores of the egg, which in a few days has visibly increased, or that finally, it serves as maternal milk to the little ugly worms (verminucci), as ordinarily seen in that sticky, and shiny viscous matter surrounding the eggs of frogs, toads, salamanders, aquatic snails, fish, and the like.

These ingenious flies, that are really worthy of the praise of

the observing Lucian, do not make their nests solely in the branches of the sweet red rose, but on the double white and damask roses I have seen them at the same game. There are different species of these flies, some of the garden, and others of the sylvan kind, these being distinct only in size or in some marking or colour. Some are yellow, the back and head blackish, and the legs marked by sooty spots. Wishing to ascertain whether these were of the race or nature (genio) of our flies, I keenly enjoyed observing their habits, and found them at work with their stings on the tender shoots of the wild rose, exactly like our fly, that is to say darting the sting into the tender twig of the bush, that I observed the 12th of May, which is shown in the third figure, Pl. 1.

I shall not dwell on all the particulars in egg laying of these sylvan flies, as the operation is the same as described of our garden kind. When the little grubs are born they feed on the leaves of the wild rose, as ours on the cultivated. Their head is furrowed by brown lines, and their legs are black at the base. In the first three segments they have six long legs, the 4th, 11th, and 12th are without any. The other rings are supplied with the usual short feet; when they walk, they usually twist the body to one side, and when still raise it in a curve. They are spotted with black stigmata, and their feces are black. The lung apertures, that are barely visible are ornamented with a black semi-circle like an ellipse in the lower part. Having shed their skin, they appear all green with a honey-coloured head, and dark eyes separated by a green line, that appears farther down the back to the tail, where two other small lines are seen on either side. In this state the respiratory openings of the tracheae are clearly seen. In the first ring they are oval, and of honey colour; in the other rings from the 4th to the 11th they are round, smaller, and encircled with black. They are also covered by short, black hairs that, before the skin was shed, were barely visible with the aid of the lens.

For several days they grew, and shed their skins, when finally, on the last of May, being sufficiently nourished, they hid under some leaves at the bottom of the box, where they made two occoons. From the first of June to the eighth, all the others set to work at building prisons for themselves, out of which they escaped after twenty days in the same shape as their fine parents.

I shall not tax your patience further with description, for they have the identical structure of the garden rose sawflies, though smaller, and all black, as seen in Pl. 1, fig. 3, where the sting is protruded in act of insertion in the branch.

Their cocoon is also of the same make, the first layer coarser, and reticulate, and the second finer and thicker. It seems larger in proportion to those of our flies. I observed these two separate cocoons in fig. 10, Pl. 1, and the first unpierced, slightly enlarged by the lens, fig. 12, same plate.

Before concluding this curious story, instructive to those who enjoy the pursuit of Natural Philosophy, I must advise you that all of this *Mosca Rosisega* folk, domestic, or wild, big, or little, when living in liberty on the rosebushes, leave the rosebush after the final shedding of their skins, climb down the stalks to the roots of the bushes where they creep in the earth, which is here usually light, and dusty. Hidden in there, they make room for themselves where they build the cocoon, sometimes but one, often many together in a heap.

They enchrysalate themselves until they cast off their covers, and come out to the light with an entirely different figure from that with which they were shut in, that is they come out winged, whereas they enclosed themselves worms (vermi). In order to get out, they gnaw a corner of the cocoon with their pincers, making an ample opening, without wetting or spreading the upper corner as do butterflies. Here are the pierced cocoons, figs. 10 and 12, Pl. 1.

To confess the truth it was hot work hunting for these cocoons in the fields, and gardens. Though I saw hordes of caterpillars denuding the rosebushes of their leaves, they would all suddenly disappear without leaving a single chrysalis remaining on trunk, leaf, or branch, as other insects do. Finally having observed that the grubs always drop to the bottom of the boxes, and do not stick to the lid, I concluded that they must act in the same way when at liberty, so I looked for them at the roots of the bushes, where I found them all, either united or separated in holes in the fine, friable soil. These act in the same way as the willow grubs, described in my Dialogues, (12) which also retire under-

(12) Dialog. 1. Gall. di Min. Part. X. car. 316.

ground after being fed enough. This fact escaped the notice even of such a great observer as Sig. REDI, as is evident in his best work on the Generation of Insects. This habit I have since found to be common to many caterpillars and worms, such as of the acorn, of the sheep's and deer's nose, of the back of cattle and of the intestine of horses and the like, all of which have this same curious instinct, to use the language of the schools.

But even if hidden prudently in the sandy soil, as in the lap of the common Mother, they do not always succeed in escaping the rapacity of other animals, for I have sometimes seen the enterprising and astute ants penetrate into these secret places, gnaw the cocoons, and drag out the unfortunate occupants to their own holes to be consumed at need.

This then is the plain tale of my pretty, clever flies, which may not be unpleasing to anyone, whose taste is not already spoiled by much reading of fables or rigmarole.

A little light, if clear, is enough to allow the sincere seeker after the truth to perceive its outlines in the dusk of uncertainty, when he will be able to distinguish features very different from those dreamed of, or capriciously imagined by certain too fantastic minds.

Some little flies are just like these flies in their mode of attack on rosebushes, only they confine themselves to sawing the rib in the middle of the leaf.

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The eggs are soaked with the juice of the leaf, and the little worms (vermicelli) are dissimilar to the above. When these come out of their nests, they do not eat the whole leaf, but only the tender parts between the fibres, the leaf being left with empty meshes like a fine net. When mature, they form chrysalids, from which comes out a small, black fly with spread, transparent wings, two horny, curved antennae, and six long legs on the thorax. The belly is composed of many rings diminishing toward the extremity, the last ring hides the innocuous sting. Pl. 1, fig. 17.

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GOEDARTIUS, in his treatise on insects, recognized several species of these flies, as the legitimate offspring of various caterpillars,

that devour plants, but his observations were so imperfect, that his commentator, LISTER, was led into the error of thinking that the rosebush flies were spurious offspring. And, thinking that GOEDARTIUS was in error, he wrote : *Partus potius spurios de Ichneumonum, aut Muscarum carnivorarum genere natos existimare* (opus est) *quam veros, atque legitimos*. But the fact is GOEDARTIUS made no mistake in that case, and did not deserve to be corrected, let the corrector rather be corrected : for it is not strange, or absurd in Nature as he thought, to find many caterpillars becoming flies, as we have seen in our subject, if indeed we will call it a fly. Hence I shall allow myself to assert the impropriety of that Classification of Insects derived by some from Caterpillars, and Worms, because not all caterpillars produce butterflies, nor all worms produce flies, as I have found many kinds of them from both. Confusion may readily arise in the classification of all these, if we do not make the distinctions from the winged form, (volatile) as the ultimate goal of worms and caterpillars, precisely after the manner of modern botanists from flowers. But of this at the end.

Not less worthy of your attention are certain other little maggots, that dig lines or hidden tunnels in the tissue of roseleaves, living on the internal, pulpy substance, and growing until ready to form chrysalids. See Pl. 2, fig. 5. This occurs on many plants, but so far as I know, has not been mentioned by the good old writers.

* * *

Some of these pupae come out as small beetles, or as weevils, or gnats like those of the oak leaves. These rosebush gnats are black, and very agile, and smaller than wine midges (the true origin of which is described in my Dialogues. (13)

They lay their eggs one by one, and fasten them to the under side of the leaf with a kind of glue, so that they may not be cooked by the sun; with only one or two on a leaf. After a few days a tiny, almost invisible maggot comes out, which hardened by exposure, and confirmed in the energy of all its parts, bores the upper leaf skin with its little mandibles, and burrows into the green tissue as in a safe grotto, which is enlarged as the inner

(13) Gall. di Min. Tom. 3, Par. 9 car 310.

pulp is consumed; it twists and turns in serpentine windings according to the quality of the food, in the same way as the little worms (vermicelli) of the mange disease burrow under our skin. Arriving at the required size, the maggot settles down, and begins to pupate (s'incrisalida). At the correct time a gnat comes out of the chrysalis, after its own kind, thus perpetuating in the usual way a species unobserved till now, and apparently useless.

The tips of the tender buds of the rosebush branches are also the receptacle of a worm (verme) called by some *Turiones*, which penetrates into their medulla, and stays there until its mutation. It is the young of a fine garden fly, which lays only one egg on top of the bud, and then flies to another, and another, until her whole load of animated contagion has been discharged, and many plants infected. The little worm having come out of the egg penetrates to the pith of the twig, where it absorbs the liquid oozing from the disintegrated fibre. It is yellowish white with a long, black spot on the back; is dotted with some dark spots along the body, and has two white lines on the sides. The semi-spherical head is like a human skull, with two very black eyes rather small in proportion. In the mouth are green hooklets, and four processes hang from the maxillae like a beard. It has six legs on the first three segments, armed with claws. It dislikes the open air, or contact, and its motion is slow. It consists of eleven segments besides the head and tail. But it is furrowed by innumerable wrinkles. The last segment is covered with scales, and is semicircular, and under it is the anus. When mature I observed it again, on the 28th of April, and noticed that in addition to the six feet, certain mamillary protruberances were thrust out in its windings that took the place of feet, for as the rings drew up to carry the body along, they let down toward the plane of the table on which they rested a prominent tubercle. See Pl. 2, fig. 6.

This is subject to many enemies, that try to devour it, so that the lateral part of the branch is often found to be corroded, and the miserable worm taken out of its nest. Also this creature changes into an aurelia, whence a fly issues in due time.

Another devastator of rosebushes is a little caterpillar like a worm, that feeds exclusively on rosebuds, observed on the 27th of April. This one binds with threads of silk drawn from its

mouth all the extremities of those dentated external leaves, called by some *alabastri*, that enclose the calyx, the heart of the flower; it arches them so that they form a dome, under which it feeds on the petals, not always escaping, however, the voracity of other insects. I saw a fly, called *Scorpiuros*, that succeeded in wounding this worm with its long proboscis, and sucked out blood and entrails. Our worm gives evidence against itself, both by the disfigured bud, and by the traces of black excrement, that mark its trail. Its colour is greenish yellow, and it is ornamented with a few hairs. Its round head is armed with pincers, and brightened with two black eyes; a black line marks the back, and it has twelve rings. It walks lazily in spite of many feet: six long ones anteriorly, and shorter ones on the rest of the belly, except the fourth, fifth, and the ring before the last. As I was observing it carefully for description, I admired its neatness, for a dry piece of dung having caught on its terminal hairs, the creature pulled it off with its mouth, and threw it away as if in disgust. It grows to medium size, then leaves the friendly nest to cast its skin, and remains a chrysalis. This chrysalis shows the antennae folded over the thorax, with the wings and feet wrapped in very fine skin. The eyes and organs of the mouth are seen. The belly is formed of nine rings, ending in a hard point armed with a hook by means of which it remains attached, and hanging, like the chrysalis of the cabbage caterpillar, described by me in the first dialogue. (14) After a few days, the skin having split, it comes out to its future nuptials as a fine butterfly.

It would take too long, dear Sir, to describe all the insects that feed on roses alone. It is enough to have mentioned some species, which you can observe without leaving your pleasant garden, and verify my sayings for your amusement. You will then see what little reliance can be placed on the opinions of many illustrious men, who try to ascertain the origin of the generation of insects in plants by their mind alone. For our mutual entertainment, I shall allow myself to touch upon some of these opinions, that were in great esteem towards the end of the last century, and at the beginning of this more sagacious one. Whence you may discern how useful experimental philosophy has been, and how

(14) Tom. 1, Gal. di Min. Part. X.

harmful mere speculation in the explanation of natural phenomena. Here are therefore some

REFLECTIONS ON PREVAILING BELIEFS CONCERNING THE ORIGIN OF INSECTS.

The celebrated Signor REDI, in his book on the Generation of insects, (15) did not think it a sin against philosophy to believe that the worms of fruits were created by the same vital principle or virtue, that causes the fruits themselves to spring from the plants. Although some schools hold that a less noble thing cannot generate one more noble, he laughs at the notion, and considers the origin of flies, and gnats in galls of the oak to be a sufficient refutation. He further says that « low », and « high » are unknown terms to nature, invented to suit the opinions of this or that sect, according to the needs of the case. Granting the claims of the Scholastics to be true, there was nothing paradoxical in the assertion that plants, in addition to their vegetal existence, possess a sensitive power to which that is subordinate, and which enables them to produce animal life. Here the wise and learned REDI brings up a long array of ancient and modern authors of like opinion, and beautifully illustrates his noble discourse with extracts from the poets, believing that VIRGIL, DANTE, and others wished to teach us by their fables, that plants are not entirely deprived of sensation; finally he passes on to the observations and deductions that you can find in the above mentioned praiseworthy book.

I am unable, however, in the face of all these elaborate arguments, and authoritative witnesses to give my assent to this celebrated writer, both on account of the reasons, that I have before stated, and on account of my own observations, and those of my Master, MALPIGHI, on the generation of galls, which are entirely contrary to the quoted propositions. I do not believe that plants can feel, as they lack the head, which is the seat of sensation, and because they cannot execute the necessary movements, being in part inflexible, and rigid; and even granted that they could feel, they would nevertheless not be able to generate insects by themselves any more than animals could generate them of

(15) Generaz. degl' Insetti, pag. m., 130.

their ownselves, as I think I have demonstrated in my first Letter (16) with regard to the generation of common worms in the human body, whereas like should produce like.

These are poetic inventions, revered Sir, bizarre fancies of Poets rather than of Philosophers, plants were never seen in the act of walking or of twisting aside from the rude touch of rustic hands, nor to cry out when broken or struck, as the branches and limbs of that horrible forest in the second Spiral of Hell broke forth in lamentations according to that Supreme Poet : (17)

> With hand outstretched I thereupon did dare
> To break a branch of blackthorn tall, and dark,
> Its trunk cried out, why dost thou my flesh tear?
> And cause my blood to redden all my bark.
> Again it cried : why dost thou torture me?
> Hast thou no pity for thy helpless mark?

Turning from this tragic scene to a more agreeable one, let us view the charming plants, playfully described by CAPORALI (18), that open their fragrant lips in song, as if they were canaries or nightingales :

> I listened to their singing in the Sun
> Uplifted chicory flowers, that told of things,
> Which to repeat of worthy words are none.
> Two roses then, made by his ray more red,
> Forgetting in their song that they were wed,
> Praised the great gift of Heavenly Love alone.

But if the roses of my little garden had voice, when punctured, and torn by those cruel flies, they would sing of something else but love. I will not stop seriously to attack this opinion concerning plant sensitiveness, because anyone can judge its quality by its musty, antique odor, and Signor REDI should have reserved a place for it in his great Dithyramb, or in his numerous love sonnets, that met with so much applause. Even Father BUONANNI, who was not free from error in this confusing subject, rejects these ideas, and concludes in his great book, On Living Animals in

(16) Consider. ed Esper. intorno la Gen. de' ver. Ord. del Corpo umano In Padova 1710.

(17) Inferno 13.

(18) Cesare Capor. Viaggio in Parn. Part. prima.

Non Living Matter (19) : *dum similia pronunciamus, ludicra agimus, fabulas compingentes.*

***

The learned Father goes on to say that nothing can be deduced by supposing something to be, if another thing were true, when this thing has not been proved by sufficient evidence to be true.

***

See Treatise on the common worms of the human body.

So far so good, but Father BUONANNI unfortunately insists that galls are real fruits, that have their origin from the roots themselves. (20) He says : *Crescitque nucleus ita gracili cortice excitatus cum Galla, eo modo quo fructuum, puta Amygdalarum nucleus, in quo fructus, cuticula, cortex ligneus, & alius cortex simul augentur, alimento desumpto à pediculo, cujus beneficio ex arbore pendent : eaque de causa Quercuum fructum appellandum esse judico, cujus rudimentum sit in radice, non casu ex vitiato humore compactum ad fovenda ova, quae musca in tenellis gemmis, surculisque composuit.* I only wish that the Reverend Father would leave Rome once in a while for a Spring outing, and entering some quiet, shady wood, observe the budding shoots of oaks, or other glandiferous plants, and putting Aristotelean texts out of his mind, would diligently search the tips of these shoots to find an aperture through which the forest fly had introduced the egg from outside, and then look inside for the egg itself. I give him my word of honour as an eye witness that he will find both with time and patience. Then I am sure that his religious sincerity, and his philosophical candour will not allow him to express any further doubt on the subject, nor to torment himself by seeking underground in the roots, the vital principle of those living creatures, which infallibly comes from outside, as we have not only said, but demonstrated.

Father BUONANNI errs in the matter of the worms of galls when he says : (21) « After they have arrived at a certain size, they do not escape in the form of flies, but die and decay in their nests. »

(19) Part. p. Cap. 31. Pag. 100, 101.
(20) Cap. 32. Part. medesima pag. 108.
(21) *Ibid.* pag. 110.

This mistaken judgment is due to the fact that the galls were gathered when immature, while the worms (vermi) were still insufficiently nourished, and had not arrived at the requisite size to pupate, and then take on the winged form. This is the case with silkworms, and all worms subject to transmutation; if these be left without sufficient food before they are properly grown, all die before the nymph state, and fail to produce the desired winged form (volatile). Gather, or have gathered for you, mature galls, and not only galls, but a hundred other kinds, false fruits, diseased excrescences, or tumours, husks, sponges or the like, and you will find that from all these not only flies are born, but little butterflies, weevils, little wasps, and other flying forms, some spurious, some legitimate : I, not having ever found that the worms which nest in these plant malformations, remain always worms (vermi), excepting spiders, that sometimes retreat accidentally into those flowers; with these we are not concerned : but I have always well seen that their true worms (vermi) or the spurious ones of the ichneumon wasps, or of carnivorous flies, perpetually in due time come out with wings, and abandon their own old nest, or the ursurped one.

The said Father made the same mistake, when having had the good fortune to witness the birth of a worm (verme) from the egg of the flea, he let it die of hunger, without being able to make its cocoon, and let out the flea : hence he supposed that it always remained a worm. The extent of his error in this matter, you may ascertain from what was written to me some years ago, by my friend Sig. CESTONI, and published by me with some annotations on the same (22), and on the origin of so many errors of ARISTOTLE, that were caused solely by the fact, that this great man began Observations, but did not finish them.

Nor should other learned Moderns (among whom GIO. B. TRIONFETTI (23), who followed HARVEY blindly) insist in believing that the egg (uovo), which is found in galls, is generated therein by itself through a certain *principio movente* donated it by courtesy, using the versatile meanings of ARISTOTLE to suit themselves. *Istud* (ovum) *sua sponte nascitur* (wrote (24) Sig. TRIONFETTI, quoting

(22) Gal. di Min. Tom. 2. Par. 2 c. 292.
(23) Lib. Vindiciar. Ver. Cap. 6.
(24) *Ibid.*

HARVEY) *ex materia sponte, vel casu concocta, ut Aristoteles videtur asserere, quorum scilicet materia potest à se ipsa moveri eo motu à casu, quo semen movet*, etc. and afterwards acknowledging a certain *primordium vegetale* imagined as a service to ARISTOTLE. I confess to my dullness : I do not understand that *vegetale primordium*, where it is neither true egg, nor true seed, and I do not, and shall not ever consider chance to be so fortunate and wise, as with regulated motion to bring together particles differing in form and size in such a perfect manner as to form a *vegetale primordium*, or make a self-moving animal with organs so minute and perfect, that they surpass the capacity of every human mind; which if it might possibly be true, do you not see would make no longer fabulous the evil thoughts of those, who insist that everything is born by chance? If indeed insects, mice, frogs, and birds (favola dell' Anitre di Berniclas) could be born of themselves, I would not have the faintest shadow of doubt that in the same way could be born dogs, bears, lions, and elephants, even men themselves : for I find in looking at the internal fabric of all these the very same admirable structure of organs; I find them all constructed with the same incomprehensible, and superhuman skill : which may not be denied save by some blind fool, or stolid ignoramus of anatomy. Wherefore as we certainly know that all animals and man, their king, were created by God, and to all were given that holy law to multiply their species, and there never having been seen the birth of a horse, or of a man from itself, as with evil ignorance some have thought possible, therefore, I shall allow myself to conclude, that no living being, however minute, even invisible, may do so.

Besides I am very much grieved, not to say scandalized, when I perceive in my reading how bitterly Italians oppose each other in the matter of facts, and how all of them hold to the opinions of foreign authors, considering them to be more precious wares than their own native goods. Both SBARAGLIA and TRIONFETTI, well known by their numerous publications, show this predilection, and the latter places HARVEY higher than our own MALPIGHI. Now I do not deny HARVEY to be a distinguished man, and that I have a special veneration for him, and that he deserves well of the Republic of Letters; but even he was napping at times, and all his writings are not to be considered as equally trustworthy.

He flourished in that part of the century that was not sufficiently enlightened, and was still encrusted with Aristotelean pitch, and heavy with rust. And in fact, if they would be willing to read SWAMMERDAM's general History of Insects, they would find that in this kind of things he esteemed him as little less than nothing, although he had been esteemed as little less than a divinity by Sig. TRIONFETTI and a few others. He demonstrates how that other (quello) fell into error in many things (25), *quae ex casca senilitate decerpsit, splendideque delirans vera falsis, falsa veris immiscuit.* Hence, after having faithfully reported the meanings of HARVEY taken from his book *De Generatione Animalium*, he concluded : (26) *Hucusque Harveus. Verum quot verba, tot fere errores haec ipsius dissertatio continet : quod ipsum eo magis miramur, quo vir hic doctissimus in arcanis naturae sacro involucro evolvendis majori diligentia, quam caeteri versatus, eorum cognitione non perfunctoria non imbutus modò, sed etiam fuerat tinctus; miramur inquam, quoties ejus viri errores adeò splendidos, & crassos in hisce respicimus; In hisce, quae ipsa rerum evidentia, vel translatitiae, & superficiariae diligentiae manifestissima ad oculum exhibet &c.* These learned Italians will have to pardon me, therefore, if I show myself inclined in certain things, to put faith in our own writings rather than in those of strangers, although professing also for them a most profound esteem.

But let us cut short these discussions which may give a bad taste to those who have a stomach full of black bile, and who do not like the frankness of our senses, nor the glory of our writers. Let us pass to another subject, Wise Sir, because it seems to me of no slight importance in the natural history of insects that we should note even fleetingly a clearer division of the same, or at least light some spark of a new light, because in the books of the good old writers in this sort of thing everything is very disorderly and obscure.

A NEW IDEA FOR A GENERAL DIVISION OF INSECTS.

Translation omitted. Original pp. 40-75.

Let us live on, therefore, my learned friend, as long as possible

(25) JOAN. SVVAMMERDAM. Histor. Insector. General. &c.
(26) Sect. 3, p. 33.

Isis, XVII, pl. 17 R. P. BIGELOW

ANTONIO VALLISNIERI (1661-1730)
Portrait engraved by ANT. LUCIANI, 1715.

Frontispiece from Opere Diverse del Sig. ANTONIO VALLISNIERI. Venezia : ERTZ, 1715.

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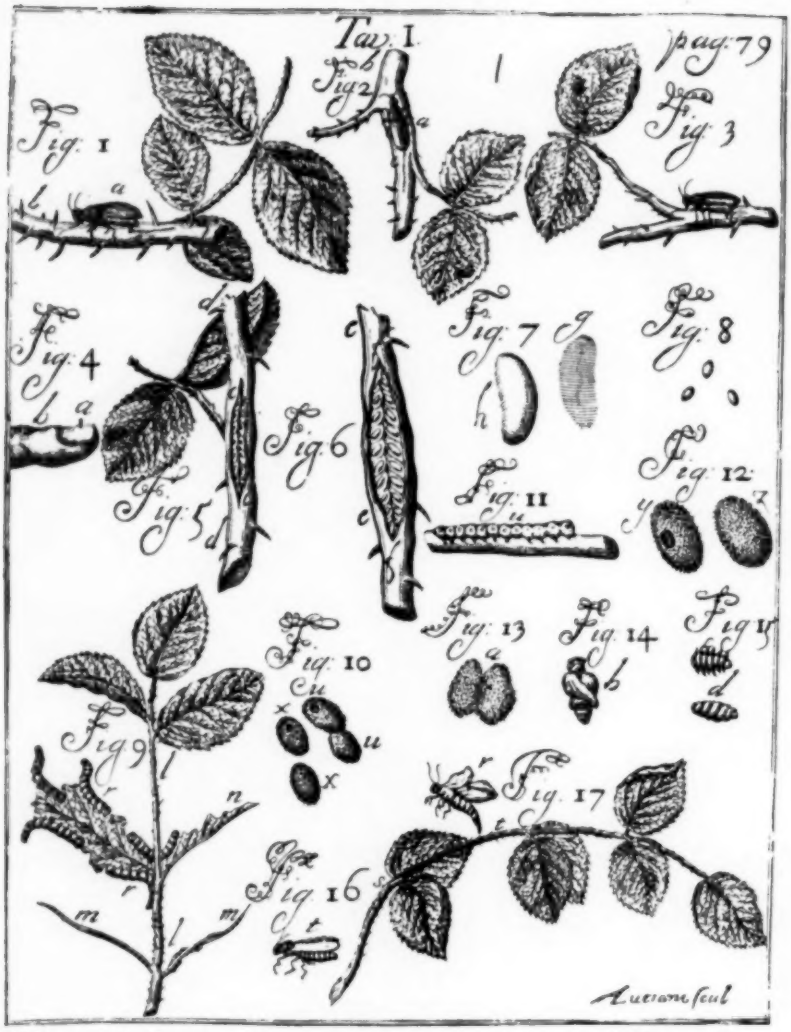
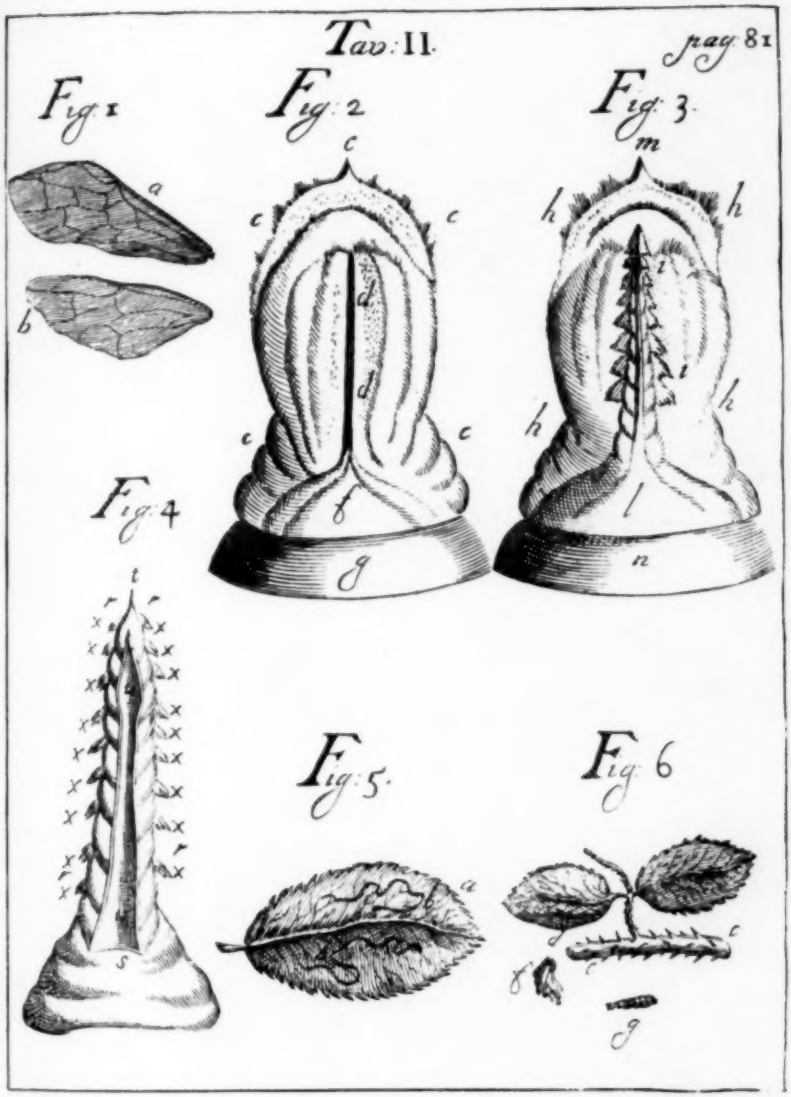


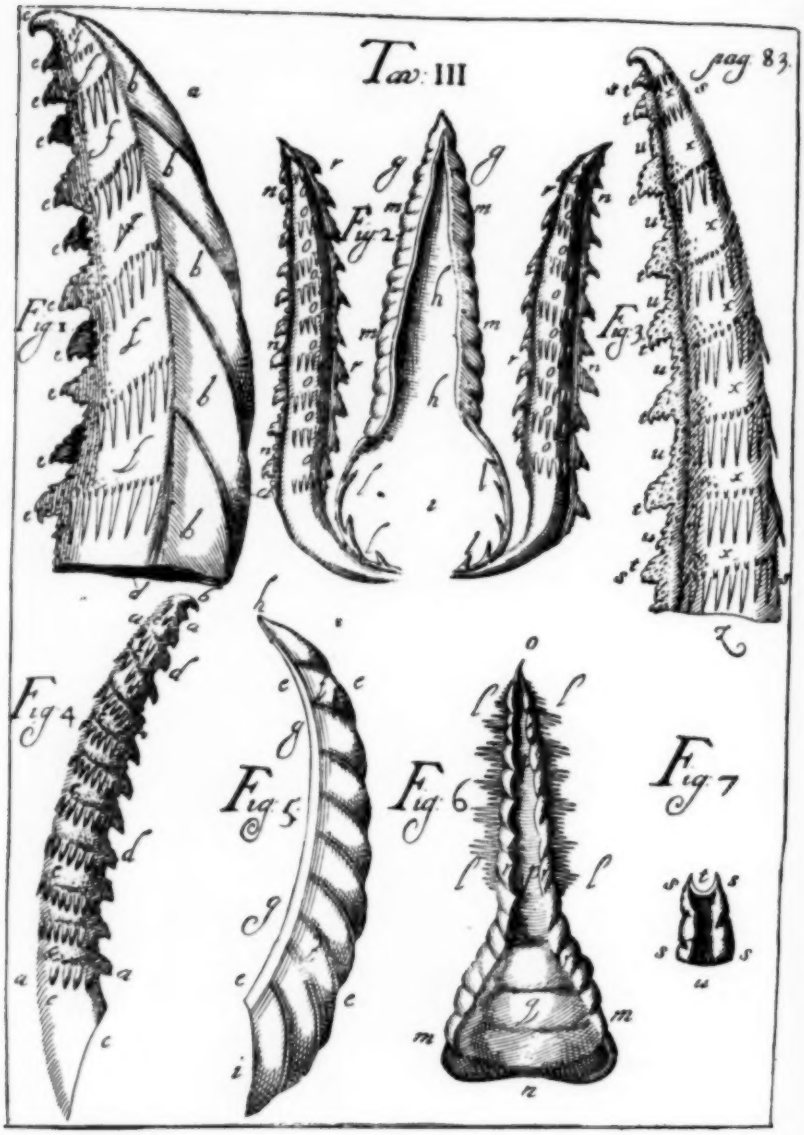
Isis, XVII, pl. 18 A. VALLISNIERI.

Osservazioni intorno alla Mosca de' Rosai, 1713.
Plate 1, engraved by A. LUCIANI.
For explanations of the figures, see page 321 f.



Isis, XVII, pl. 19 A. VALLISNIERI.

Osservazioni intorno alla Mosca de' Rosai.
Plate 2. Explanation of figures, p. 322 f.



Isis, XVII, pl. 20 — A. VALLISNIERI

Osservazioni intorno alla Mosca de' Rosai.
Plate 3. Explanation of figures, p. 323 f.

in order to witness a great change in the minds of men, when some repenting of time lost will alter their manner of study, and leaving to moths and weevils various uselessly venerated writers, will break away into new paths, and find new ways of arriving at the truth. They would be displeased were they not in time to sing that celebrated verse :

Bella geri placuit nullos habitura triumphos.

Meanwhile you have the advantage of having always followed the right though hard road known to few. You have observed nature's own work as shown in the rare herbs and simples of your pleasant garden, and now you will perhaps be interested in watching the insects, that nest in your flowers, as many great botanists have done. For the sake of recreation you might now vary your study without changing your place, and while you are admiring an open flower notice if perchance an intruder has crept into it, bent on devouring the delicate petals. Thus one study could be carried on without interruption of the other, and with increased observation, greater knowledge will be gained of the beauties and wonders of nature.

I need not tell you that the slightest discovery is of the greatest value, and is more easily obtained by the aid of the senses than by the mind alone. This is the message of DESCARTES to posterity : *Pluris esse facienda Artificum experimenta, quam steriles, & prae subtilitate evanescentes Eruditorum contemplationes.*

Explanation of the Figures of the Plates of the Fly of Rosebushes

PLATE I

FIGURE 1. *a*. Garden Rose fly in the act of splitting the tender branch, and depositing eggs therein with drawn sting.
b. Branch of rosebush. *c*. Furrow made by the sting.

FIGURE 2. *a*. Same fly, seen from the back, in the act of ovipositing.
b. Cut branch of rosebush. *c*. Fissure in which eggs are hid.

FIGURE 3. *a*. Fly of the wild rose, which is ovipositing.
b. Cut branch. *c*. Unsheathed sting ready for oviposition.

FIGURE 4. *a*. The sting of a rose-fly, natural size, placed fantastically by the painter upon a human fingernail.
b. Human finger with the nail, which serves as a base for the sting.

FIGURE 5. *d.d*. Stem of the rose cut off at both ends. *c.c* Wound or furrow made by the fly, beginning to open, and to show the eggs in a few days time.

FIGURE 6. *e.e.* Cut branch without leaves. *f.f.* Wound made by the sting, broadening with the growth of branch after some days, showing eggs deposited, each in a separate little cell divided by a wall of woody fibre; the eggs being placed in two rows that are also divided longitudinally by another fibrous partition wall.

FIGURE 7. *g.h.* Two eggs extracted from their niche and enlarged.

FIGURE 8. *i.i.i.* Three eggs of natural size taken from their cells.

FIGURE 9. *l.l.* Spray of roseleaves with worms in act of devouring it.
m.m. Two leaves all eaten except the mid-rib.
n. Another leaf half eaten.
r.r.r.r.r. Five caterpillars feeding on the leaves.
s.s.s. Leaves still intact, to be devoured later on finishing the lower ones.

FIGURE 10. *u.u.* Two cocoons slightly less than real size, formed underground at roots, or lower stem of rosebush, by two worms fed to repletion, and having attained full size. One cocoon shows opening from which the fly emerged.
x.x. Two other cocoons of the wildrose fly, less than natural size.

FIGURE 11. Caterpillar of rosebush enlarged by a microscope, on a small cut twig, for observation.

FIGURE 12. *z.* Cocoon of the same somewhat magnified.
y. Another with the lateral opening from which the fly has escaped.

FIGURE 13. *a.* Cocoon split, and spread outward, having the appearance of a grating of coarse fibre.

FIGURE 14. *b.* Chrysalis, or aurelia, of the fly, enlarged, found inside of the cocoons.

FIGURE 15. *c.* Cast larval skin somewhat enlarged, found inside of cocoons at base of chrysalis.
d. Same skin, not enlarged but distended.

FIGURE 16. *t.* Male of rose sawfly.

FIGURE 17. *r.* Smaller fly enlarged, which also splits the mid-rib of the roseleaf, and might be called the leaf sawfly.
t. Place where sting is inserted.
s. Leaf stem.

PLATE II

FIGURE 1. *a.* Anterior wing of garden sawfly magnified by microscope showing the fine textures of its fibres.
b. Posterior wing.

FIGURE 2. *c.c.c.c.* Extremity of lower abdomen microscopically enlarged, and seen from below where the sting is enclosed.
d.d. Fissure in centre where the sting is embedded.
e. Fleshy point like a tail ending the lower abdomen.
f. Base of the sting.
g. Last ring of abdomen.

FIGURE 3. *h.h.h.h.* Extremity described before of the lower abdomen of another fly of the same species, enlarged, however, as before.
i.i. The sting, drawn out of the median fissure, appears at once armed on each side by spines.
l. Base of the sting.
m. Ultimate caudate extremity of the lower abdomen.
n. Last ring of the lower abdomen.

FIGURE 4. *r.r.r.r.* Sting removed from its niche, enlarged by a good microscope, and seen from the back.
s. Base of sting.
t. Point of sting.
u.u. Canal, the back of which is shown, flanked on both sides by a spiral body bordering the interior.
x.x.x.x. Groups of teeth showing on both sides.

FIGURE 5. *a.* Leaf with small worms feeding on the pulp between the two layers of the integument.
b.b. Track of said worms.

FIGURE 6. *c.* Cut rose twig within which is found the little worm, *g*, feeding on the pith.
d. Place where the worm has entered, *f*, which part dries up and falls off in time.
e. Spot that has softened, and changed colour where the worm lies.
g. Worm taken from its nest.

PLATE III

FIGURE 1. *a.a.* Sting enlarged with a good microscope and seen from the side.
b.b.b.b. Spiral back of sting.
c. Point of the saw showing a claw.
d. Place where the sting is cut off.
e.e.e.e. Teeth of saw furnished with other small teeth directed toward the base. Note that in this figure are seen also the teeth of the other saw.
f.f.f.f. Other lateral teeth made differently, like a pendant spine from a membranous base, that are hung in regular order on the sides of the saw. All of which are raised and lowered with the movement of the saw, when thrust in the branch.

FIGURE 2. *g.g.g.g.* Enlarged sting separated into the three parts in which it is naturally divided, the centre part being an exterior oviduct, that carries the eggs into the cells of the furrow on the branch dug out by the other parts that are the saws.
h.h.h.h. Cavity or canal in the middle of the oviduct.
i. Expansion of the lower part where the eggs are received.
l.l.l.l. Internal margins of the rounded dilation of the same, armed with hairs or appendages turned up so that the egg is kept in, and pushed along the median canal.
m.m.m.m. Spiral sides of oviduct.
n.n.n.n. Lateral saws separated from oviduct.
o.o.o.o. A part facing the saws armed with many rows of hanging and moveable teeth.
r.r.r. Inner side of the saws also armed with teeth.

FIGURE 3. *s.s.s.s.* A single saw separated.
t.t.t.t. etc. Teeth of the saw supplied with secondary denticles.
u.u.u.u. etc. Interval between teeth armed with denticles.
x.x.x.x. Rows of another kind of lateral teeth pendant from a flexible base, horny and hard like the rest.
z. Place where the saw was cut off.
y. Clawed point of saw, slightly denticulate.

FIGURE 4. *a.a.a.a.* Saw of wildrose fly entirely separated with base.
b. Claw and dentated point of saw.
c. Base of saw.
d. Teeth of the cutting edge also denticulate, with interstitial minute teeth.
e.e.e.e. etc. Teeth of another kind hanging from sides of saw on each side.

FIGURE 5. *e.e.e.e.* Oviduct, which with the saw forms the whole sting, seen from the side.
f.f.f.f. Spiral funiculi, that serve for shortening, bending, and peristaltic movements.
g.g. Concave part of oviduct, which is flexible.
h. Apex of oviduct.
i. Truncated base of oviduct, which in nature is longer.

FIGURE 6. *l.l.l.l.* A sting seen from the front undetached from its lateral sides, drawn separately, with its spines hanging from the raised sides, so that their length may be seen as well as the method by which they are raised and lowered on the branch.
m.m. External base of the sting shown entire.
o. Apex of sting.
p.p. Canal by which the eggs are discharged.
q. Internal base of sting.
r.r.r.r. etc. Sides of the oviduct of spiral form.

FIGURE 7. *s.s.s.s.* A portion of the sting upstanding, and viewed perpendicularly through the microscope, to show its canals or anterior and posterior cavities.
t. Upper part cut off transversely showing the semicircular anterior canal.
u. Lower part also cut off near the base.
x. Another minor canal of the back, or apparent groove or fold, made casually by the membrane of the interior canal, which in that place when not dilated is slightly drawn inward.

End of the explanation of the plates

Marcus Marcis Untersuchungen über das Prisma und ihr Verhältnis zu Newtons Farbentheorie

Öfters wird der Prager Artzt und Naturforscher MARCUS MARCI (1) als ein Vorläufer NEWTONS in der Aufstellung der physikalischen Farbentheorie angeführt; er hat namentlich erkannt, dass 1.) zu den verschiedenen, durch ein Prisma erzeugten farbigen Strahlen verschiedene Brechungen eindeutig entsprechen; 2.) diese so definierten monochromatischen Strahlen ihre Farbe bei weiterer Brechung unverändert behalten : zwei Sätze, die in der Tat einen wesentlichen Teil der NEWTONschen Farbentheorie bilden. Nun ist natürlich diese letzte Behauptung so weit richtig; ich hielte es aber doch nicht für zweckmässig, bloss auf Grund dieser Tatsache MARCI als Vorläufer NEWTONS hinzustellen. Denn, ganz abgesehen von der Frage, ob NEWTON die Ausführungen MARCIS gekannt hat oder nicht, soll doch die Geschichte der Physik nicht als eine blosse chronologische Aneinanderreihung von isolierten Entdeckungen aufgefasst werden, sondern das Hauptgewicht soll vielmehr gelegt werden auf die logischen Zusammenhänge zwischen den einzelnen Schritten, die zur Entwicklung einer physikalischen Theorie beitragen. Um zu beurteilen, ob von diesem Standpunkt eine gegebene Theorie als Vorläuferin einer anderen, vollkommeneren, bezeichnet werden kann, müsste also vor allem folgende Frage entschieden werden : genügt, um von der ersten Theorie zur zweiten zu gelangen, eine Erweiterung und sinngemässe Modifikation der wesentlichen Begriffsbildungen, oder ist eine völlige Verwerfung der Grundvorstellungen der ersten

(1) Vgl. E. HOPPE, *Archiv für Geschichte der Mathematik*, 10, 282, 1927. Ein Bildnis MARCIS findet sich in E. MACHS *Mechanik*, 8. Aufl. Leipzig 1921, S. 311 abgebildet.

Theorie erforderlich? Nur im ersten Fall könnte von einem historischen Zusammenhang die Rede sein. In diesem Sinne wäre zum Beispiel die GALILEIsche Mechanik eine Vorläuferin der NEWTONschen, diese letztere wieder eine Vorläuferin der EINSTEINschen, oder auch die ältere Quantentheorie eine Vorläuferin der neueren Quantenmechanik; keineswegs aber könnte man, trotz der oberflächlichen Aehnlichkeit, eine historische Verknüpfung erblicken zwischen dem DE BROGLIEschen Begriff der Phasenwelle und der eigentümlichen Wellenvostellung, die NEWTON in seine Lichtkorpuskeltheorie einzufügen versuchte, um die « fits of easy reflexion and transmission » zu erklären (2). Wie steht es nun in dieser Hinsicht mit MARCIS Farbentheorie? Im folgenden möchte ich versuchen, diese Frage zu beantworten, und zwar wird sich herausstellen, dass MARCI als Vorläufer NEWTONS im eben erklärten Sinne nicht angesehen werden kann.

I. — *Die Newtonsche Farbentheorie*

Wir wollen zunächst an den wohlbekannten Gedankengang der NEWTONschen Theorie (3) erinnern. Dann werden wir MARCIS Untersuchungen, soweit sie für unsern Zweck von Interesse sind, auseinandersetzen, um schliesslich einen Vergleich zwischen beiden Theorien anzustellen.

Der Hauptzug der NEWTONschen Ausführungen ist ihr streng induktiver Charakter, ihre völlige Unabhängigkeit von jeder apriorischen Vorstellung über die Natur des Lichts. Er geht aus von der Betrachtung des gewöhnlichen Sonnenspektrums. Nach dem Brechungsgesetz steht die beobachtete Ausdehnung des Spektrums senkrecht zur Prismenachse im Widerspruch mit der Annahme eines einzigen, für alle Strahlen gleichen Brechungsindex. Es gilt somit, die verschiedenen Strahlenarten zu trennen und einzeln zu untersuchen : dies leistet das *Experimentum crucis*, welches zeigt, dass 1.) für jede Strahlenart das gewöhnliche Brechungsgesetz gilt, bloss mit verschiedenen Werten des Brechungsindex, 2.) zwischen Brechungsindex und Farbe eine eindeutige stetige Zuordnung existiert. Daraus werden dann die Begriffe der « einfachen » und der « zusammengesetzten » Farben

(2) Vgl. etwa L. ROSENFELD, *Isis*, 11, 116, 1928.
(3) Vgl. L. ROSENFELD, *Isis*, 9, 44, 1927.

scharf abgeleitet, wobei die Rolle des Prismas als « Farbenanalysator » klar hervortritt.

II. — *Marcis Untersuchungen über das Prisma*

Gehen wir jetzt über zur Analyse der uns interessierenden Abschnitte des optischen Werkes von MARCI : *Thaumantias, Liber de Arcu coelesti* (4). Zunächst muss betont werden, dass MARCI noch ganz im Banne der Scholastik steht : seine Behandlungsmethode besteht in subtilen, auf Autoritäten gestützten Argumentationen; wenn Experimente angeführt werden, so geschieht es immer nur in letzter Linie, zur Bestätigung der scholastisch ermittelten Schlüsse, und nie als Ausgangspunkt einer induktiven Ueberlegung : Erfahrungstatsachen werden ungefähr auf demselben Fuss wie schriftliche Autoritäten behandelt. Ferner begnügt sich MARCI meist mit oberflächlichen, oft falsch gedeuteten, Beobachtungen; selten geht er bis zum Quantitativen; eine Diskussion oder Analyse seiner Versuchsresultate führt er an keiner Stelle systematisch durch.

Von Anfang an legt er eine bestimmte Vorstellung über die Erzeugung der Farben aus weissem Licht durch « Kondensation » zugrunde; diese « Kondensation » hat übrigens nichts zu tun mit der Intensität des Lichtes. Indem sie Kondensationsänderungen hervorruft, erzeugt die Brechung eines weissen Lichtstrahles verschiedene farbige Strahlen (Theorema X, p. 69). Aber die Farben werden nicht durch die bei der Brechung stattfindenden Ablenkung der Strahlen hervorgerufen (Th. VIII, p. 68). Nichtsdestoweniger lässt sich eine Zuordnung herstellen zwischen den verschiedenen Farben und den verschiedenen Brechungen : « Th. XII (p. 83). Lux non nisi refractione certa in medio denso mutatur in colores : diversaeque colorum species sunt partus refractionum. »

Hier muss nebenbei bemerkt werden, dass das Brechungsgesetz MARCI unbekannt ist.

Auf S. 94 fängt nun eine ausführliche Untersuchung über das Prisma an : « De Iride trigonia deque illius proprietatibus et earundem causis ».

(4) *Thaumantias*, Liber de arcu coelesti deque colorum apparentium natura, ortu et causis... Authore JOANNE MARCO MARCI. Pragae, Typis Academicis 1648 (268 p.)

Nach einer Beschreibung der trivialen Eigenschaften des Spektrums, wird der Zuordnungssatz zwischen Spektralfarbe und Brechung mit Rücksicht auf den oben angeführten Satz XII leicht « bewiesen » :

« Th. XVIII (p. 99). Neque idem color a diversa refractione, neque ab eadem plures colores esse possunt. »

Die beiden folgenden Sätze besagen nun, dass die Spektralfarben bei weiterer Reflexion oder Brechung unverändert bleiben : « Th. XIX (p. 100). Reflexio superveniens radio colorato non mutat rationem coloris. »

« Th. XX (p. 100). Refractio superveniens radio colorato non mutat speciem coloris. »

Dieser letzte Satz ist gerade das Hauptergebnis des berühmten *Experimentum crucis* von NEWTON. Was sagt aber MARCI darüber ? Um zugleich ein Beispiel seines Stils anzugeben, zitiere ich wörtlich den Anfang des « Beweises », wo die herangezogenen Experimente beschrieben sind :

« Constitue pilam crystallinam medio inter visum et trigonum loco : lumenque candelae, una cum coloribus, eversum spectabis : nulla in his facta mutatione... Simili modo in pictura a trigono proxime et mediante pila crystallina, aut per trigonum geminatum transmissa, eosdem prorsus colores videbis. Quin etiam horum singulos per se, nova refractione, in iridem circularem atque unicolorem transformare postea docebo. Sicuti vero refractio superveniens nihil officit radio colorato, ita praevia nihil eidem opitulatur. Quod si enim sphaera pellucida media inter trigonum et luminosum radios praeoccupet, duo (5) simulachra ejusdem flammae recipies, iisdem prorsus coloribus, eodemque situ dispositis : licet hujus simulachrum sit eversum... ».

Von diesen Versuchen kommt dem *Experimentum crucis* am nächsten der an dieser Stelle nur erwähnte, aber erst später (Porisma III, p. 254) in anderem Zusammenhang beschriebene, von der Erzeugung eines monochromatischen kreisförmigen Lichtstreifens. Es handelt sich nämlich um das Bild, welches durch ein ringförmiges Prisma erzeugt wird, wenn als Lichtquelle irgend ein monochromatischer Strahl aus einem durch ein gewöhnliches

(5) Er stellt immer das Prisma in bezug auf das *breite* Lichtbündel so, dass zwei (spiegelbildliche) Spektren entworfen werden.

Prisma gebildeten Spektrum benutzt wird. Dabei wird der monochromatische Strahl nicht etwa durch eine Blende ausgewählt, sondern das ringförmige Prisma wird in so grosser Entfernung vom ersten Prisma gestellt, dass es ganz von einem einzigen « monochromatischen » Spektralstreifen beleuchtet werden kann !

Auf Seiten 105-106 wird dann die Behauptung ausgesprochen, dass weder die erste Brechung allein (d.h. die Brechung an der Eintrittsfläche des Prismas), noch die zweite (an der Austrittsfläche) allein, das farbige Spektrum erzeugen kann. Denn wäre das Spektrum z.B. durch die erste Brechung allein erzeugt, so könnte es auf Grund von Satz XX durch die zweite Brechung nicht gestört werden, und würde infolgedessen unabhängig vom Winkel der beiden Flächen auftreten : dies widerspricht aber der Erfahrung mit plan-parallelen Platten.

Es folgt nun auf S. 107 ein ziemlich unerwarteter Satz :

« Th. XXXI. Radii deferentes simulachra colorum sunt diversi a radiis deferentibus speciem objecti. »

Wenn nämlich, etwa bei den zum Beweis von Satz XX benutzten Versuchen, duch ein Prisma ein Bild mit farbigem Rand von einem Gegenstand entworfen wird, so wird durch eine dazwischen gestellte Linse das Bild umgekehrt, während die Farben am Rande unverändert bleiben : diese werden also durch spezielle Strahlen (radii colorigeni) erzeugt, welche von der Linse nicht auf dieselbe Weise beeinflusst werden wie die bilderzeugenden Strahlen. Wie ist es aber zu erklären, dass diese Farben immer am Rande der Bilder erscheinen ? Die Antwort lautet einfach : Zuweilen fallen Farbstrahlen zufälligerweise mit Bildstrahlen zusammen (« Per accidens autem fit, quod radii colorati quandoque coincidunt cum specie objecti »); wegen der grösseren Intensität der letzteren, ist aber auf dem Bilde selbst nichts von den Farben zu merken; nur am Rande kann man die Irisation beobachten (S. 177).

III. — *Kritik der Marcischen Theorie*

Diese Skizze der Marcischen Vorstellungen über die Entstehung der Farben spricht eigentlich von selbst und wir können jetzt die anfangs gestellte Frage in wenigen Worten erledigen.

Was zunächst die eindeutige Zuordnung zwischen Farben und

Brechungen betrifft, so hat MARCI, trotz der scheinbar so scharfen Fassung seines Satzes XVIII, alle wesentlichen Punkte übersehen : er glaubt, dass die Dispersion der Farben nicht durch die Ablenkung der Strahlen an einer Trennungsfläche zustandekommt; er hat ferner keinen Begriff von der Stetigkeit der Dispersion, wie sein Gebrauch von « monochromatischen » breiten Spektralstreifen deutlich zeigt (6). Infolgedessen fehlt ihm eine klare Unterscheidung der « einfachen » und « zusammengesetzten » Farben (obwohl er natürlich doch eine verschwommene Idee von diesem Unterschied hat), was ihn zu seiner fantastischen Auffassung der Bilderzeugung und Randirisation verleitet.

Was nun die Unzerlegbarkeit der Spektralfarben angeht, so darf auch die Tragweite des Satzes XX nicht überschätzt werden. Das *Experimentum crucis* hat er nur in primitiver und unexakter Form; was aber wichtiger ist : er betrachtet es gar nicht als kruzialer Versuch, sondern eher als eine nebensächliche Spielerei. Die anderen Experimente werden sogar ganz falsch gedeutet : er behauptet nämlich, dass die Linse bzw. die durchsichtige Kugel, die auf dem Weg der Lichtstrahlen eingeschaltet werden, *gar keine* Farben erzeugen (7), sondern nur das Bild modifizieren. Schliesslich nimmt im MARCIschen Buch dieser Satz XX keine Zentralstellung ein : er benutzt ihn nicht etwa zu einer Definition der « einfachen » Farbe, sondern nur für dialektische Zwecke (wovon ein Beispiel oben angegeben wurde).

Zusammenfassend müssen wir also feststellen, dass MARCI weder über den präzisen Inhalt noch über die Bedeutung seiner beiden Sätze im Klaren war und dass seine Ausführungen als Ausgangspunkt für eine Farbentheorie unmöglich hätten benutzt werden können.

(Universität Lüttich) L. ROSENFELD.

(6) Er unterscheidet übrigens explizite nur vier Farbenarten. Aber auch NEWTON stellt Spekulationen über eine endliche Farbenskala an, obwohl er anderseits die physikalische Stetigkeit des Spektrums scharf formuliert.

(7) Auffallend ist bei MARCI das Fehlen jedes Abstraktions- und Verallgemeinerungsvermögens : hier entgeht ihm die Wesensgleichheit der Linse und des Prismas. Bei seinen Untersuchungen über den Stoss, behandelte er viele Spezialfälle richtig, gelangte aber nicht zum allgemeinen Stossgesetz.

Le dernier autographe de Newton

Le dernier autographe de NEWTON est probablement la brève « entry » que l'on trouve à la date du 26 février 1726/7 dans un livre de comptes tenu en grande partie par JOHN CONDUITT (1688-1737), le neveu par alliance de l'illustre savant (1) et qui est conservé à la Henry E. Huntington Library, San Marino, California. Ce carnet, intitulé : « 1726 Account current with Sr ISAAC NEWTON », mérite de ne pas échapper à l'attention de ceux qui se livreront à des recherches biographiques nouvelles sur l'auteur des *Principia*, dont il contient çà et là quelques lignes autographes; il s'étend jusqu'au 10 juillet 1727.

J. PELSENEER.

(1) Mort le 20 mars 1726/7.

Discovery of the main nutation of the earth's axis

With facsimile reproduction (no. XV) of JAMES BRADLEY's *account of it (Philosophical Transactions, no.* 485 *beginning Vol.* 45, *p.* 1-43, 1748*).*

I.—Progressive changes in the longitudes of all the stars were recognized very early by ancient astronomers. In fact they could not fail to be recognized as soon as a new catalogue of stars was compared with an earlier one. However crude the observations, a sufficiently long interval of time would bring the changes to light. As far as we know the first astronomer to be clearly aware of them was the Babylonian KIDINNU (1), c. 343 B.C. The discovery of that phenomenon—the precession of the equinoxes—is generally ascribed to HIPPARCHOS who flourished two centuries later. HIPPARCHOS was enabled to make it because of the observations accumulated by earlier Babylonian and Greek astronomers, but whether he used their theories as well as their observations is uncertain. In any case he had a much deeper understanding of the precession than his Babylonian and Greek predecessors could possibly have and he gave a satisfactory account of it. For a true explanation, one had naturally to wait until the publication of NEWTON's *Principia* (1687).

II.—NEWTON himself had already realized that the (luni-solar) precession of the equinoxes, i.e., the slow conical motion of the earth's axis, was not the only motion of that axis, but that there was also a small periodical inclination of it. See *Principia* (Lib. III, Prop. XXI, Theor. XVII).

(1) Or KIDENAS, CIDENAS. PAUL SCHNABEL : KIDENAS, HIPPARCH und die Entdeckung der Präzession (*Zeitschrift für Assyriologie*, 3, 1-60, 1926; *Isis*, 10, 107).

« Puncta Aequinoctialia regredi, et Axem terrae singulis revolutionibus annuis nutando bis inclinari in Eclipticam et bis redire ad positionem priorem.

« Patet per Corol. 20. Prop. lxvi. Lib. 1. Motus tamen iste nutandi perexiguus esset debet, et vix aut ne vix quidem sensibilis. (2)

NEWTON's suggestion could not remain unnoticed. It was repeated in a letter addressed by JOHN FLAMSTEED to JOHN WALLIS, on Dec. 20, 1698 (3). But better than that ROEMER in 1693 finding himself unable to explain some variation in the declination of stars by refraction or parallax remarked « sine dubio ad vacillationem aliquam poli terrestris referendam cujus me verisimilem dare posse theoriam observationibus munitam spero. » (4)

III.—It is not very surprising then that when BRADLEY observed unaccountable motions of the stars, one of his first thoughts was to explain them by means of a nutation « A Nutation of the Earth's Axis was one of the first things that offered itself upon this Occasion, but it was soon found to be insufficient. (5) It was only after having tried and rejected the hypothesis of nutation that he discovered the aberration. This is interesting from the point of view of « priority » discussions : BRADLEY thought of nutation before aberration, yet it took him some twenty years longer to complete his discovery of the former than that of the latter. It may also help us to realize the difference between an « idea » or « suggestion », and a genuine discovery.

IV.—Indeed to think of nutation was one thing, to prove experimentally its existence and to measure it was another. There was an immense difference in that respect between nutation and precession. As the effects of the latter were accumulating and would continue to accumulate for a total period of some 26,000 years, it was impossible not to discover precession sooner or later, irrespective of astronomical progress. On the contrary, not only is nutation very small, but its period is very short (about 18 2/3 years) : hence its discovery was hardly possible except

(2) That is the whole of that prop. XXI (NEWTON, *Opera*, ed. S. HORSLEY, t. 3, 49, 1782), but the suggestion of a small inclination or nutation is clear enough.

(3) Fieri potest ut suspicetur quis, exiguam *nutationem* axis telluris... posse quadantenus efficere hanc mutationem apparentis a Polo distantiae in Polari stella... (WALLIS : *Opera*, vol. 3, 706, Oxford, 1699).

(4) PEDER HORREBOW : Operum mathematico-physicorum tomus tertius, continens Basin astronomiae cum triduo Roemeriano, etc. (65, Copenhagen, 1741).

(5) See facsimile of his paper on Aberration in *Isis*, 16, 233-65 (p. 641).

with very refined instruments. Such instruments became available in BRADLEY's time; in fact, he was himself, with the collaboration of such great craftsmen as GEORGE GRAHAM (1673-1751) and later JOHN BIRD (1709-76), one of their creators. Moreover he was a born observer of extraordinary skill and care, and was able to improve his experimental opportunities to the limit.

Nowhere does what I called before his « classical » spirit assert itself better. To begin with his discovery of nutation originated because there were « residual phenomena » which precession, aberration and other known facts could not account for. These « residual phenomena » were very small (less than 2"), and most contemporary astronomers, if they had detected them, would have charged them to their instruments and let them go at that, —but BRADLEY was harder to please. He considered the possibilities of instrumental errors and excluded them or took them into account. Whatever divergencies remained had to be explained in one way or another, they could not be simply ignored. He was already aware of these residual phenomena or « small varieties » or « small alterations » when he wrote his paper on aberration. (See first facsimile, p. 652).

« I have likewise met with some small Varieties in the Declination of other Stars in different Years, which do not seem to proceed from the same Cause, particularly in those that are near the solstitial Colure, which on the contrary have altered their Declination less than they ought, if the Precession was 50". But whether these small Alterations proceed from a regular Cause, or are occasioned by any Change in the Materials, etc. of my Instrument, I am not yet able fully to determine »...

V.—From the time when these remarks were written, BRADLEY never ceased to think of the « small alterations » and to improve and accumulate his observations in order to solve the riddle. After ten years of patient observations he was able to write to MAUPERTUIS : (6)

« In my account above referred to, I have taken notice that, so far as I could then judge from the observations of a single year, the annual precession of the equinox was at that time greater than 50", the stars near the equinoctial colure, (between the years 1727 and 1728) changing their declination 1" ½ or 2" more than a precession of 50" required. On the other hand, I observed that stars near the solstitial colure altered their declination less than they ought if the precession was 50". Which seeming contradiction in the phenomena, with regard

(6) Letter dated October 27, 1737 (*Miscelaneous works*, p. 408).

to the stars in those different situations, I now conceive to arise from the unequal action of the moon upon the equatorial parts of the earth, which, varying on account of the different inclination of her orbit to the equator, will cause a small nutation in the earth's axis, as also an acceleration and retardation in the precession of the equinoxes. The whole quantity of this nutation, I find, amounts to about 9" each way from the mean. »

This theory was not a novelty to him when he confided it to MAUPERTUIS; there is good reason to believe that at that time it had already guided his own observations for many years (at least five). Almost exactly twelve months later (7) he wrote to the same :

« I have already given you an account of the phenomena which induced me to think that there is a small nutation of the earth's axis, which I conceived was occasioned by the unequal action of the moon on the equatorial parts of the earth. What I can farther collect from this year's observations tends to confirm my former conjecture; the principal stars which I observe, in order to discover this motion, being now evidently returning back again with a contrary motion to that which they had during my first nine years' observations. But whether they will entirely recover their original situation by the end of the period of eighteen years, I cannot yet determine from the observations of these two last years only. There seems, indeed, from my latest observations, some reason to suppose that they will not; but the difference between the hypothesis and observations scarce amounting at present to more than a single second, I cannot pretend to say whether that is owing to any thing besides the uncertainty of the observations themselves, and therefore must refer the decision of this point to future experience. »

Compare these statements with those contained in his final paper of 1748 (see facsimile, e.g., p. 11) and admire his extraordinary prudence.

VI.—MAUPERTUIS was well aware of the importance of BRADLEY's new theory and far less prudent for he did not hesitate to publish it. Other astronomers already made use of it. Yet BRADLEY continued his work undisturbedly on the basis indicated in his second letter to MAUPERTUIS above quoted : he must complete a whole cycle (i.e. an entire revolution of the moon's nodes) and even go a little beyond. When this was done, if the results already obtained were confirmed, it would be time to publish them, not before. And then finally he was able to give a complete and indisputable account of the discovery at a meeting of the Royal Society, on February 14, 1747, i.e., 1748. The paper itself is dated by the author, Greenwich, Dec. 31, 1747 (See facsimile, p. 43).

(7) Letter dated Oct. 28, 1738. (*Miscellaneous works*, p. 411).

VII.—Inasmuch as BRADLEY's new theory had already been accepted before its final publication, it encountered no resistance. A curious consequence of it was a momentary revival of anti-Newtonianism in Paris. At that time three great mathematicians were engaged in studying the problem of three bodies, especially with regard to lunar theory : EULER in Berlin, CLAIRAUT and D'ALEMBERT in Paris. There was an intense rivalty between them, especially between the two young Frenchmen. Both had written papers on the subject, and both had been stopped by the same difficulty,—the theoretical movement of the moon's apogee was only about half the observed one. CLAIRAUT had reached the conclusion that the Newtonian law of gravitation was probably incorrect, and he regarded at first BRADLEY's discovery as a new means of shattering the Newtonian structure. Acknowledging BRADLEY's memoir, he wrote to him : (8)

« Sans doute que vos observations exerceront beaucoup les géomètres pour chercher la cause des mouvemens que vous avés remarqués. C'est une nouvelle route que vous leur ouvrés; mais la théorie qui doit y conduire est bien difficile, et peut-être toute entière à découvrir. Car celle que M. NEWTON a donnée sur la précession des équinoxes me paroit bien loin de suffire pour cela. D'ailleurs je vous avouerai que cette théorie ne m'a jamais satisfait, je n'ai point reconnu dans sa méthode de prendre en total les mouvemens des parties de la terre ni la subtilité ni la sureté ordinaire de ce grand homme. Je n'entrerai pas actuellement dans un grand détail sur cette matière, parce qu'il y a déjà fort longtems que je ne l'ai examinée, et que je suis occupé à une autre partie du système du monde, qui mérite aussi une grande attention. C'est la théorie de la lune. Vous aurés peut-être entendu parler d'un mémoire que j'ai lu à l'assemblée publique de la S. Martin dernière. Quoiqu'il en soit, voici de quoy il étoit question dans ce mémoire. J'avois premièrement résolu le problème connu sous le nom de problème des trois corps, dans lequel je déterminois la courbe décrite par un corps autour d'un autre, par la lune, par exemple, autour de la terre, pendant que ces deux corps sont attirés l'un et l'autre par un troisième corps. J'avois toujours trouvé de grandes difficultés dans la théorie de la lune de M. NEWTON, à cause que tous les points différens qui la composent sont examinés chacun en particulier, comme si les autres ne s'y compliquoient pas, et je ne pensois pas qu'on put être satisfait sur cette matière avant d'avoir vu une solution complète du problème où toutes les considérations entrent à la fois.

La mienne m'a conduit heureusement à une équation de l'orbite de la lune dont tous les termes sont fort simples; ils ne renferment chacun qu'un sinus d'angle très-aisé à réduire en tables, aussitôt que les quantités qui entrent dans les coefficiens sont déterminés par les observations. Ce que mes recherches m'ont donné de plus important, c'est cette remarque, à laquelle je ne m'attendois pas, que le mouvement de l'apogée n'étoit que d'un peu moins de la moitié de ce

(8) August 19, 1748 (*Miscellaneous works*, 451-53).

que les observations apprennent, en sorte qu'en ce point l'attraction, du moins telle que M. NEWTON l'a supposée, n'est pas suffisante pour expliquer les mouvemens de la lune.

Ce qui m'a paru de plus simple pour remédier à cet inconvénient, c'est de supposer une autre loy d'attraction que celles des quarrés des distances. En exprimant cette loy ainsi $\frac{1}{d^2} + \frac{a}{d^m} + \frac{b}{d^n}$ + etc. on peut rendre les exposans et les coefficiens de ces termes tels que les mouvemens des planètes principales seront sensiblement les mêmes que dans la loy ordinaire, et que le mouvement de l'apogée de la lune qui en résultera sera le réel. De plus on pourra expliquer par la même loy tous les phénomènes pour lesquels on avoit recours à des loix particulières, comme l'ascension des liqueurs dans les tuyaux capillaires, la réfraction de la lumière, &c. La généralité de cette loy m'a parû un avantage. Au reste je ne suis pas attaché à mon explication, et je suis prêt à en accepter toute autre qui répondra aux phénomènes. Je ne m'éloignerois pas, par exemple, de supposer entre l'attraction ordinaire de M. NEWTON quelqu'autre espèce d'attraction particulière à la terre, et qui agiroit sur la lune. *Mais quelque chose qu'on imagine, il me paroît démontré qu'il faut autre chose que l'attraction ordinaire inversement proportionelle aux quarrés des distances.* »

I have not hesitated to quote a long part of this letter, because of its importance. (The underlining of the last sentence is mine). It should be noted that CLAIRAUT's doubts as to the correctness of the Newtonian law of gravitation were shared for a time by EULER himself. These doubts gave a new lease of life, a very short one it is true, to the Cartesian party which was still fighting rearguard actions on the continent. However in 1749 d'ALEMBERT published his *Recherches sur la précession des équinoxes et sur la nutation de l'axe de la terre* (fig. 1), wherein these phenomena were completely explained in Newtonian language, and CLAIRAUT himself revised his calculations and found that the discrepancy between the Newtonian theory and the observations was due to the fact that certain terms which began by being negligible and which he discarded accordingly did not remain so : when they were fully taken into account the discrepancy vanished. CLAIRAUT retracted his error, and his theory of the moon, crowned by the Russian Academy, was purely Newtonian, as was emphatically stated in the very title (*Théorie de la lune déduite du seul principe de l'attraction réciproquement proportionelle aux quarrés des distances*, Paris, 1752; second edition, 1765).

VIII.—This incident is doubly instructive. In the first place, CLAIRAUT's error was a remarkable instance of the danger of neglecting terms without having made sure that their negligibility was permanent—a danger many times illustrated in the history

RECHERCHES

SUR LA PRÉCESSION

DES EQUINOXES,

ET SUR LA NUTATION

DE L'AXE DE LA TERRE,

DANS LE SYSTÈME NEWTONIEN.

Par M. D'ALEMBERT, *des Académies Royales des Sciences de Paris & de Berlin, & de la Société Royale de Londres.*

A PARIS,

Chez DAVID l'aîné, Libraire, rue S. Jacques, à la Plume d'or.

MDCCXLIX.

AVEC APPROBATION ET PRIVILEGE DU ROI.

of celestial mechanics. This kind of error was the natural result of the introduction of analytical methods; NEWTON's lunar theory was geometrical and qualitative; the analytical methods made quantitativeness possible with various degrees of approximation. Mathematicians had to learn by experience that it was not easy to predict the final approximation when terms were abandoned in the course of the calculations, and that such a procedure, generally unavoidable, was full of pitfalls. In the second place, CLAIRAUT's revolt was the first attempt to discredit the NEWTON theory of attraction on the basis of new observations, and when the discrepancies were explained away, the discredit was turned into an additional confirmation of that theory.

IX.—The immense value of BRADLEY's work lies not only in his discovery but in his masterly way of establishing it. This was due to the extraordinary accuracy of his observations, their number and their length. According to the suggestion of his friend JOHN MACHIN (d. 1751), nutation tables might be calculated on the assumption that the moon's attraction caused the pole of the earth to describe a small circle around its mean precessional place. BRADLEY's object was then to determine the magnitude of this circle. He found that a better agreement would be obtained with his observations if the circle were replaced by an ellipse, with major and minor axes equal respectively to 18" and 16". In fact some of his observations would have led to the adoption of a longer major axis, nearer to 19". According to the latest measurements, the two axes measure respectively 18",42 and 13".72. (9)

X.—To conclude I beg to draw the reader's attention to the statements made at the end of BRADLEY's paper (p. 39 and following in the facsimile printed below). BRADLEY conceived the possibility of proper motions of the stars and of our own solar system, and indicated means of investigation. In this he was a prophet (more than two centuries ago) of the amazing developments of stellar astronomy, and this is additional proof—if such were needed—that he was not simply a clever and patient observer, but also a man of vision and of genius.

XI.—BRADLEY's rewards were commensurate with the greatness

(9) *Annuaire du Bureau des Longitudes pour l'an* 1930 (p. 215).

of his accomplishment. Many of the honors referred to in my first paper were bestowed upon him only after his second discovery. The Copley medal was awarded to him in 1748. However the greatest rewards of a scientist are not the formal ones—these are hardly more than labels—but rather the informal and spontaneous marks of recognition from his friends, colleagues, and countrymen. For example, when a lecturer spoke in the Theatre at Oxford in 1751, of the benefactors of the university, he made a special mention of Sir HENRY SAVILE's (1549-1622) foundations (10) « Qui viri academici ! quanta in mathesi nomina ! SAVILIO debemus BRIGGIUM, WALLISIUM, HALLEIUM; eidem SAVILIO GREAVIUM, WARDUM, WRENNUM, GREGORIUM, KEILUM, ne nominem quem posteri numquam tacebunt. » And RIGAUD from whom I have this, adds with joyous pride and some pardonable exaggeration : « BRADLEY was himself present : there was no one in the crowded assembly on whom the allusion was lost, or who did not feel the truth and justice of it : all eyes were turned to him, while the walls rung with shouts of heartfelt affection and admiration : —it was like the triumph of THEMISTOCLES at the Olympic games. »

Cambridge, Mass. GEORGE SARTON.
Oct. 8, 1930.

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(The Roman numerals refer to the paragraphs of my introduction; the Arabic ones to the pages of BRADLEY's memoir).

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The following facsimile is reproduced thanks to the courtesy of the Library of Congress, of the Harvard Library (for p. 1, 4, 5, 8, 9) and of Mr. FREDERICK E. BRASCH, Secretary of the History of Science Society. For BRADLEY's portrait, see *Isis*, vol. 16, pl. 2, p. 233, 1931.

Page 16 is immediately followed by page 19, because of an error in pagination; there never were any pp. 17-18.

I. *A Letter to the Right honourable* George *Earl of* Macclesfield *concerning an* apparent Motion *obſerved in ſome of the* fixed Stars ; *by* James Bradley *D. D. Aſtronomer Royal, and F. R. S.*

My LORD,

Read at a Meeting of the Royal Society, *Febr.* 14. 1747.

THE great Exactneſs, with which Inſtruments are now conſtructed, hath enabled the Aſtronomers of the preſent Age to diſcover ſeveral Changes in the Poſitions of the heavenly Bodies; which, by reaſon of their *Smallneſs*, had eſcaped the Notice of their Predeceſſors. And altho' the Cauſes of ſuch Motions have always ſubſiſted, yet Philoſophers had not ſo fully conſider'd, what the Effects of thoſe known Cauſes would be, as to demonſtrate *a priori* the *Phænomena* they might produce; ſo that Theory itſelf is here, as well as in many other Caſes, indebted to Practice, for the Diſcovery of ſome of its moſt elegant Deductions. This points out to us the great Advantage of cultivating *this*, as well as every other Branch of Natural Knowledge, by a regular Series of Obſervations and Experiments.

The Progreſs of Aſtronomy indeed has always been found, to have ſo great a Dependence upon

accurate Obſervations, that, till ſuch were made, it advanced but ſlowly: For the firſt conſiderable Improvements that it received, in point of Theory, were owing to the renowned *Tycho Brahè*; who far exceeding thoſe that had gone before him, in the Exactneſs of his Obſervations, enabled the ſagacious *Kepler* to find out ſome of the principal Laws, relating to the Motion of the heavenly Bodies. The Invention of Teleſcopes and Pendulum-Clocks affording proper Means of ſtill farther improving the *Praxis* of Aſtronomy; and theſe being alſo ſoon ſucceeded by the wonderful Diſcoveries made by our Great *Newton*, as to its Theory; the Science, in both reſpects, had acquired ſuch extraordinary Advancement, that future Ages ſeemed to have little room left, for making any great Improvements. But, in fact, we find the Caſe to be very different; for, as we advance in the means of making more nice Inquiries, new Points generally offer themſelves, that demand our Attention. The Subject of my preſent Letter to your Lordſhip, is a Proof of the Truth of this Remark: for, as ſoon as I had diſcovered the Cauſe, and ſettled the Laws of the Aberrations of the fixed Stars, ariſing from the Motion of Light, *&c.* whereof I gave an Account in N°. 406. of the *Philoſophical Tranſactions*; my Attention was again excited by another *new Phænomenon, viz.* an annual Change of Declination in ſome of the fixed Stars; which appeared to be ſenſibly *greater* about that time, than a Preceſſion of the Equinoctial Points of 50″ in a Year would have occaſioned. The Quantity of the Difference, tho' ſmall in itſelf,

was

was rendered perceptible, thro' the Exactneſs of my Inſtrument, even in the firſt Year of my Obſervations; but being then at a Loſs to gueſs, from what Cauſe that greater Change of Declination proceeded, I endeavoured to allow for it in my Computations, by making uſe of the *obſerved* annual Difference, as mentioned in *p.* 652. of the ſame *Tranſaction*.

From *that* time to the preſent, I have continued to make Obſervations at *Wanſted*, as Opportunity offered, with a View of diſcovering the Laws and Cauſe of this *Phænomenon*: For, by the Favour of my very kind and worthy Friend *Matthew Wymondeſold* Eſq, my Inſtrument has remained, where it was firſt erected; ſo that I have been able, without any Interruption, which the Removal of it to another Place would have occaſioned, to proceed on with my intended Series of Obſervations, for the Space of twenty Years: a Term ſomewhat exceeding the whole Period of the Changes, that happen in this *Phænomenon*.

When I ſhall mention the *ſmall* Quantity of the Deviation, which the Stars are ſubject to, from the Cauſe that I have been ſo long ſearching after; I am apprehenſive, that I may incur the Cenſure of ſome Perſons, for having ſpent ſo much Time in the Purſuit of ſuch a ſeeming Trifle: But the candid Lovers of Science will, I hope, make due Allowance for that natural Ardour, with which the Mind is urged on towards the Diſcovery of Truths, in themſelves perhaps of *ſmall* Moment, were it not that they tend to illuſtrate others of greater Uſe.

The apparent Motions of the heavenly Bodies are ſo complicated, and affected by ſuch a Variety of

Cauſes; that in many Caſes it is extremely difficult to aſſign to each its due Share of Influence; or diſtinctly to point out, what Part of the Motion is the Effect of one Cauſe, and what of another: And whilſt the joint Effects of *All* are only attended to, great Irregularities and ſeeming Inconſiſtencies frequently occur; whereas, when we are able to allot to each particular Cauſe its proper Effect, Harmony and Uniformity uſually enſue.

Such ſeeming Irregularities being alſo blended with the unavoidable Errors, which Aſtronomical Obſervations muſt be always liable to, as well from the Imperfection of our Senſes, as of the Inſtruments that we make uſe of, have often very much perplex'd thoſe, who have attempted to ſolve the *Phænomena:* and till Means are diſcovered, whereby we can ſeparate and diſtinguiſh the *particular* Part of the whole Motion, that is owing to each reſpective Cauſe, it will be impoſſible, to be well aſſured of the Truth of any Solution. For theſe Reaſons, we generally find, that the more exact the Inſtruments are, that we make uſe of, and the more regular the Series of Obſervations is, that we take; the ſooner we are enabled to diſcover the Cauſe of any new *Phænomenon.* For when we can be well aſſured of the Limits, wherein the Errors of the Obſervations are contain'd; and have reduced them within as narrow Bounds as poſſible, by the Perfection of the Inſtruments which we employ; we need not heſitate to aſcribe ſuch apparent Changes, as manifeſtly exceed thoſe Limits, to ſome other Cauſes. Upon theſe Accounts it is incumbent upon the *practical* Aſtronomer,

Aſtronomer, to ſet out at firſt with the Examination of the Correctneſs of his Inſtruments; and to be aſſured that they are ſufficiently exact for the Uſe he intends to make of them: or at leaſt he ſhould know, within what Limits their Errors are confined.

This Practice has, in an eminent manner, been lately recommended by your Lordſhip's noble Example; who having, out of a ſingular Regard for the Science of Aſtronomy, erected an Obſervatory, and furniſhed it with as complete an *Apparatus* of Inſtruments, as our beſt Artiſts could contrive; would not fully rely on their Exactneſs, till their Diviſions had undergone the ſtricteſt Re-examination: whereby they are probably now render'd as perfect in their kind, as any extant, or as human Skill can at preſent produce.

The Lovers of *this* Science in general, cannot but acknowledge their Obligations to your Lordſhip on this Account; but I find myſelf more particularly bound to do it; ſince, by means of your Lordſhip's moſt accurate Obſervations, I have been enabled to ſettle ſome *principal Elements*; which I could not at preſent otherwiſe have done, for want of an Inſtrument at the Royal Obſervatory, *proper* for that Purpoſe: For the large *mural Quadrant* which is there fixed to obſerve Objects lying Southward of the Zenith, however *perfect* an Inſtrument it may be in it ſelf, is not *alone* ſufficient to determine, with proper Exactneſs, either the *Latitude* of the Obſervatory, or the Quantity of Refraction correſponding to different Altitudes: For it being too heavy to be conveniently removed; and the Room wherein it is placed, being too ſmall to admit of its being

being turned to the oppoſite Side of the Wall, whereon it now hangs; I cannot, by *actual* Obſervations of the circumpolar Stars, ſettle thoſe neceſſary Points; and therefore have endeavoured to do it, by comparing my own with your Lordſhip's Obſervations: and until this Defect in the *Apparatus* belonging to the Royal Obſervatory be removed, we muſt be indebted to your Lordſhip, for the Knowledge of its true Situation.

A Mind intent upon the Purſuit of any kind of Knowledge, will always be agreeably entertained, with what can ſupply the moſt proper means of attaining it: Such, to the practical Aſtronomer, are exact and well-contriv'd Inſtruments; And I reflect with Pleaſure on the Opportunities I have enjoyed, of cultivating an Acquaintance and Friendſhip with the Perſon, that, of all others, has moſt contributed to their Improvement. For I am ſenſible, that if my own Endeavours have, in any reſpect, been effectual to the Advancement of Aſtronomy; it has principally been owing to the Advice and Aſſiſtance given me by our worthy Member Mr. *George Graham*; whoſe great Skill and Judgment in Mechanicks, join'd with a complete and practical Knowledge of the Uſes of Aſtronomical Inſtruments, enable him to contrive and execute them in the moſt perfect manner.

The Gentlemen of the *Royal Academy* of *Sciences*, to whom we are ſo highly obliged for their exact Admeaſurement of the Quantity of a Degree under the Arctic Circle, have already given the World very convincing Proofs of *his* Care and Abilities in thoſe Reſpects; and the particular Delineation, which they have lately publiſhed, of the ſeveral Parts of

of the *Sector*, which he made for them, hath now rendered it needleſs, to enter upon any minute Deſcription of *mine* at *Wanſted*; both being conſtructed upon the ſame Principles, and differing in their component Parts, chiefly on account of the different Purpoſes, for which they were intended.

As mine was originally deſigned to take only the *Differences* of the Zenith Diſtances of Stars, in the various Seaſons of the Year, without any View of diſcovering their *true* Places; I had no Occaſion to know exactly, what Point on the Limb correſponded to the *true* Zenith: and therefore no Proviſion was made in my Sector, for the changing of its Situation for that Purpoſe. Neither was it neceſſary that the Diviſions or Points on the Arc ſhould be ſet off, with the utmoſt Accuracy, Equidiſtant from each other; becauſe, when I obſerve any particular Star, the ſame Spot or Point being firſt biſected by the Plumb-line, and then the Screw of the Micrometer turn'd until the Star appears upon the middle of the Wire, that is fixed in the common Focus of the Glaſſes of the Teleſcope; I can thereby collect, how far the Star is from that given Point at the Time of Obſervation: and afterwards, by comparing together the ſeveral Obſervations that are made of it, I am able to diſcover what apparent Change has happen'd. The Quantity of the viſible Alteration, in the Poſition of the Stars, being expreſſed by Revolutions and Parts of a Revolution, of the Screw of the Micrometer; I endeavoured to determine, with great Care, the true Angle anſwering thereto: and after various Trials, I thoroughly ſatisfied myſelf, both of the Equality of the

the Threads of the Screw, and of the preciſe Number of Seconds correſponding to them.

But altho' theſe Points could be ſettled with great Certainty, I was nevertheleſs obliged to make one Suppoſition; which perhaps to ſome Perſons may ſeem of too great Moment in the preſent Inquiry, to be admitted without an evident Proof from Facts and Experiments. For I *ſuppoſe*, that the Line of Collimation of my Teleſcope has invariably preſerved the ſame Direction, with reſpect to the Diviſions upon the Arc, during the whole Courſe of my Obſervations. And indeed it was on account of the Objections, which might have been raiſed againſt ſuch a *Poſtulate*, that I thought it neceſſary, to continue my Series of Obſervations for ſo many Years, before I publiſhed the Concluſions, which I ſhall at preſent endeavour to draw from them.

Whoever compares the Reſult of the ſeveral Trials, that have been made by the Gentlemen of the *Academy* of *Sciences*, for determining the Zenith Point of their Sector, ſince their Return from the North; will, I preſume, allow that *mine* is not an unreaſonable or precarious *Suppoſition:* ſince it is evident, from their Obſervations, that the Line of Collimation of that Inſtrument underwent no ſenſible Change in its Direction, during the Space of more than a whole Year; altho' it was ſeveral times taken down, and ſet up again in different and remote Places; whereas *mine* hath always remained ſuſpended in the ſame Place.

But beſides ſuch a ſtrong Argument for the Probability of the Truth of my *Suppoſition*, I have the Satisfaction of finding it *actually* verified by the Obſervations

Obſervations themſelves; which plainly prove, that at the End of the full Period of the Deviations which I am going to mention, the Stars are found to have the ſame Poſitions by the Inſtrument, as they ought to *have*, ſuppoſing the Line of Collimation to have continued unaltered from the Time when I firſt began to obſerve.

I have already taken notice, in what manner this *Phænomenon* diſcover'd itſelf to me at the End of my firſt Year's Obſervations, *viz.* by a *greater* apparent Change of Declination in the Stars near the Equinoctial Colure, than could ariſe from a Preceſſion of 50″ in a Year; the mean Quantity now uſually allowed by Aſtronomers. But there appearing at the ſame time, an Effect of a quite contrary Nature, in ſome Stars near the Solſtitial Colure, which ſeem'd to alter their Declination *leſs* than a Preceſſion of 50″ required; I was thereby convinced, that all the *Phænomena*, in the different Stars, could not be accounted for, merely by ſuppoſing, that I had aſſumed a wrong Quantity for the Preceſſion of the Equinoctial Points:

At firſt, I had a Suſpicion, that ſome of theſe ſmall apparent Alterations in the Places of the Stars, might poſſibly be occaſioned by a Change, in the Materials, or in the Poſition of the Parts of my Sector: But, upon conſidering how firmly the Arc, on which the Diviſions or Points are made, is faſtened to the Plate, wherein the Wire is fixed that lies in the Focus of the Object-Glaſs; I ſaw no Reaſon to apprehend, that any Change could have happened in the Poſition of that Wire and thoſe Points. The Suſpenſion therefore of the Plummet being the moſt likely Cauſe, from whence I conceived any Uncer-

tainty could ariſe; and the Wire of which had been broken three or four times in the firſt Year of my Obſervations: I attempted to examine, whether Part of the 'forementionꝺ apparent Motions might not have been owing, to the different Plumb-lines that had been made uſe of. In order to determine this, I adjuſted a particular Point of the Arc to the Plumb-line, with all the Exactneſs I could; and then taking off the old Wire, I immediately hung on another, with which the ſame Spot was again compared. I repeated the Experiment three or four times, and thereby fully ſatisfied myſelf, that no ſenſible Error could ariſe from the Uſe of different Plumb-lines; ſince the various Adjuſtments of the ſame Point agreed with each other, within leſs than half a Second.

Having then, from ſuch Trials, ſufficient Reaſon to conclude, that theſe *ſecond* unexpected Deviations of the Stars, were not owing to any Imperfection of my Inſtrument; after I had ſettled the Laws of the Aberrations ariſing from the Motion of Light, *&c.* I judged it proper to continue my Obſervations of the ſame Stars; hoping that, by a regular and longer Series of them, carried on thro' ſeveral ſucceeding Years, I might, at length, be enabled to diſcover the *real* Cauſe of ſuch apparent Inconſiſtencies.

As I reſided chiefly at *Wanſted*, after my Sector was erected there in the Year 1727. till the Beginning of *May* 1732. when I removed from thence to *Oxford:* I had, during my Abode at *Wanſted*, frequent Opportunities of repeating my Obſervations; and thereby diſcovered ſo many Particulars relating

to

to theſe *Phænomena*, that I began to gueſs what was the real Cauſe of them.

It appeared from my Obſervations, that, during this Interval of Time, ſome of the Stars near the Solſtitial Colure, had changed their Declinations 9″ or 10″ *leſs*, than a Preceſſion of 50″ would have produced; and, at the ſame time, that, others near the Equinoctial Colure, had altered theirs about the ſame Quantity *more*, than a like Preceſſion would have occaſioned: the North Pole of the Equator ſeeming to have approached the Stars, which come to the Meridian with the Sun, about the Vernal Equinox and the Winter Solſtice; and to have receded from thoſe, which come to the Meridian with the Sun, about the Autumnal Equinox and the Summer Solſtice.

When I conſider'd theſe Circumſtances, and the Situation of the Aſcending Node of the Moon's Orbit, at the time when I firſt began my Obſervations; I ſuſpected, that the Moon's Action upon the Equatorial Parts of the Earth might produce theſe Effects: For, if the Preceſſion of the Equinox be, according to Sir *Iſaac Newton*'s Principles, cauſed by the Actions of the Sun and Moon upon thoſe Parts; the Plane of the Moon's Orbit being at *one* time, above ten Degrees *more* inclined to the Plane of the Equator, than at *another*; it was reaſonable to conclude, that the Part of the whole annual Preceſſion, which ariſes from her Action, would in different Years be varied in its Quantity; whereas the Plane of the Ecliptic, wherein the Sun appears, keeping always nearly the ſame Inclination to the Equator, *that* Part of the Preceſſion, which is owing to the Sun's Action, may be the ſame every

Year: And from hence it would follow, that, altho' the *mean* annual Preceſſion, proceeding from the joint Actions of the Sun and Moon, were 50″; yet the *apparent* annual Preceſſion might ſometimes exceed, and ſometimes fall ſhort, of that mean Quantity, according to the various Situations of the Nodes of the Moon's Orbit.

In the Year 1727. when my Inſtrument was firſt ſet up, the Moon's Aſcending Node was near the Beginning of *Aries*; and conſequently, her Orbit was as much inclined to the Equator, as it can at any time be; and then the *apparent* annual Preceſſion was found, by my firſt Year's Obſervations, to be greater than the *mean:* which proved, that the Stars near the Equinoctial Colure, whoſe Declinations are moſt of all affected by the Preceſſion, had changed *theirs*, above a tenth Part more than a Preceſſion of 50″ would have cauſed. The ſucceeding Years Obſervations proved the ſame Thing; and in three or four Years time the Difference became ſo conſiderable, as to leave no Room to ſuſpect, that it was owing to any Imperfection, either of the Inſtrument or Obſervations.

But ſome of the Stars, which I had obſerved, that were near the Solſtitial Colure, having appeared to move, during the ſame time, in a manner contrary to what they ought to have done, by an Increaſe in the Preceſſion; and the Deviations in them being as remarkable as in the others, I perceived that ſomething more, than a mere Change in the Quantity of the Preceſſion, would be requiſite to ſolve this Part of the *Phænomenon*. Upon comparing my Obſervations of Stars near the Solſtitial Colure, that were almoſt

almoſt oppoſite to each other in Right Aſcenſion, I found, that they were equally affected by this Cauſe; for whilſt γ *Draconis* appeared to have moved Northward, the ſmall Star, which is the 35th *Camelopardali Hevel.* in the *Britiſh* Catalogue, ſeem'd to have gone as much towards the South: which ſhew'd, that this apparent Motion, in both thoſe Stars, might proceed from a Nutation in the Earth's Axis; whereas the Compariſon of my Obſervations of the ſame Stars, *formerly* enabled me to draw a different Concluſion, with reſpect to the Cauſe of the annual Aberrations ariſing from the Motion of Light. For the apparent Alteration in γ *Draconis*, from *that* Cauſe, being as great again as in the other ſmall Star, proved, that *that Phænomenon* did not proceed from a *Nutation* of the Earth's Axis; as, on the contrary, *this* may. Upon making the like Compariſon between the Obſervations of other Stars, that lie nearly oppoſite in Right Aſcenſion, whatever their Situations were with reſpect to the Cardinal Points of the Equator, it appeared, that their Change of Declination was nearly equal but contrary; and ſuch as a Nutation or Motion of the Earth's Axis would effect.

The Moon's Aſcending Node being got back towards the Beginning of *Capricorn* in the Year 1732. the Stars near the Equinoctial Colure appeared, about that time, to change their Declinations no more, than a Preceſſion of 50″ required; whilſt ſome of thoſe near the Solſtitial Colure altered *theirs* above 2″ in a Year leſs, than they ought. Soon after, I perceived the annual Change of Declination of the former to be diminiſhed, ſo as to become *leſs* than

50″

50″ of Preceſſion would cauſe; and it continued to diminiſh till the Year 1736. when the Moon's Aſcending Node was about the Beginning of *Libra*, and her Orbit had the *leaſt* Inclination to the Equator. But by this time, ſome of the Stars near the Solſtitial Colure had altered their Declinations 18″ *leſs*, ſince the Year 1727. than they ought to have done from a Preceſſion of 50″. For γ *Draconis*, which in thoſe nine Years ſhould have gone about 8″ more *Southerly*, was obſerved in 1736. to appear 10″ more *Northerly*, than it did in the Year 1727.

As this Appearance in γ *Draconis*, indicated a Diminution of the Inclination of the Earth's Axis to the Plane of the Ecliptic; and as ſeveral Aſtronomers have ſuppoſed *that* Inclination to diminiſh regularly; if this *Phænomenon* depended upon ſuch a Cauſe, and amounted to 18″ in nine Years, the Obliquity of the Ecliptic would, at that rate, alter a whole Minute in thirty Years; which is much faſter than any Obſervations, *before* made, would allow. I had Reaſon therefore to think, that *ſome Part* of this Motion at the leaſt, if not the *Whole*, was owing to the Moon's Action upon the Equatorial Parts of the Earth; which I conceived, might cauſe a libratory Motion of the Earth's Axis. But as I was unable to judge, from only nine Years Obſervations, whether the Axis would entirely recover the ſame Poſition, that it had in the Year 1727. I found it neceſſary to continue my Obſervations thro' a whole Period of the Moon's Nodes; at the End of which I had the Satisfaction to ſee, that the Stars returned into the ſame Poſitions again; as if there had been no Alteration at all in the Inclination of the Earth's Axis: which

which fully convinced me, that I had gueſſed rightly as to the Cauſe of the *Phænomena*. This Circumſtance proves likewiſe, that if there be a gradual Diminution of the Obliquity of the Ecliptic; it does not ariſe only from an Alteration in the Poſition of the Earth's Axis, but rather from ſome Change in the Plane of the Ecliptic itſelf: becauſe the Stars, at the End of the Period of the Moon's Nodes, appeared in the ſame Places, with reſpect to the Equator, as they ought to have done, if the Earth's Axis had retained the ſame Inclination to an invariable Plane.

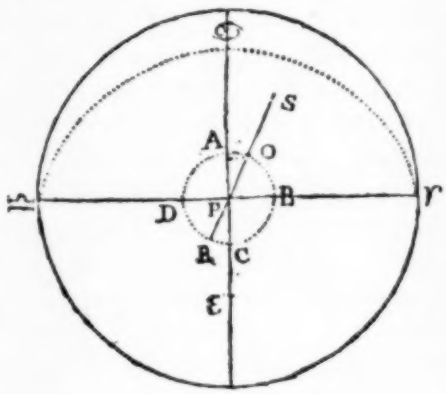
During the Courſe of my Obſervations, our ingenious Secretary of the *Royal Society*, Mr. *John Machin*, being employed in conſidering the Theory of Gravity; and its Conſequences, with regard to the Celeſtial Motions; I acquainted him with the *Phænomena* that I had obſerved: and at the ſame time mentioned, *what* I ſuſpected to be the Cauſe of them. He ſoon after ſent me a Table, containing the Quantity of the annual Preceſſion in the various Poſitions of the Moon's Nodes, as alſo the correſponding Nutations of the Earth's Axis; which was computed upon the *Suppoſition*, that the *mean* annual Preceſſion is 50″, and that the Whole is governed by the Pole of the Moon's Orbit only: and therefore he imagined, that the Numbers in the Table would be too *large*; as in Fact they were found to be. But it appeared, that the Changes which I had obſerved, both in the annual Preceſſion and Nutation, kept the ſame Law, as to increaſing and decreaſing, with the Numbers of his Table. Thoſe were calculated upon the Suppoſition,

that

that the Pole of the Equator, during a Period of the Moon's Nodes, moved round in the Periphery of a little Circle, whoſe Center was 23° 29′ diſtant from the Pole of the Ecliptic; having itſelf alſo an angular Motion of 50″ in a Year, about the ſame Pole: The North Pole of the Equator was conceived to be in *that* Part of the ſmall Circle, which is fartheſt from the North Pole of the Ecliptic, at the Time when the Moon's Aſcending Node is in the Beginning of *Aries:* and in the oppoſite Point of it, when the ſame Node is in *Libra.*

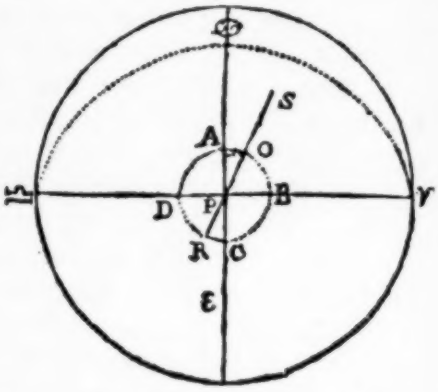
Such a Hypotheſis will account for an Acceleration and Retardation of the annual Preceſſion; as alſo for a Nutation of the Earth's Axis: And if the Diameter of the little Circle be ſuppoſed equal to 18″; which is the whole Quantity of the Nutation, as collected from my Obſervations of γ *Draconis:* then all the *Phænomena* in the ſeveral Stars which I obſerved, will be very nearly ſolved by it.

Let *P* repreſent the mean Place of the Pole of the Equator, about which Point, as a Center, ſuppoſe the true Pole to move in the Circle *ABCD*, whoſe Diameter is 18″. Let *E* be the Pole of the Ecliptic, and *EP* be equal to the mean Diſtance between the Poles of the the Equator and Ecliptic; and ſuppoſe the true Pole



Pole of the Equator to be at *A*, when the Moon's Aſcending Node is in the Beginning of *Aries*; and at *B*, when the Node gets back to *Capricorn*; and at *C*, when the ſame Node is in *Libra:* at which time the North Pole of the Equator being nearer the North Pole of the Ecliptic, by the whole Diameter of the little Circle *AC* equal to 18″; the Obliquity of the Ecliptic will then be ſo much *leſs* than it was, when the Moon's Aſcending Node was in *Aries*. The Point *P* is ſuppoſed to move round *E*, with an equal retrograde Motion, anſwerable to the mean Preceſſion ariſing from the joint Actions of the Sun and Moon: while the true Pole of the Equator moves round *P*, in the Circumference *ABCD*, with a retrograde Motion likewiſe, in a Period of the Moon's Nodes, or of eighteen Years, and ſeven Months. By this means, when the Moon's Aſcending Node is in *Aries*, and the true Pole of the Equator at *A*, is moving from *A* towards *B:* it will approach the Stars, that come to the Meridian with the Sun about the Vernal Equinox; and recede from thoſe that come with the Sun near the Autumnal Equinox, *faſter* than the *mean* Pole *P* does. So that, while the Moon's Node goes back from *Aries* to *Capricorn*, the *apparent* Preceſſion will ſeem ſo much *greater* than the *mean*; as to cauſe the Stars, that lie in the Equinoctial Colure, to have altered their Declination 9″, in about four Years and eight Months, *more* than the mean Preceſſion would do: and in the ſame time, the North Pole of the Equator will ſeem to have approached the Stars, that come to the Meridian with the Sun at our Winter Solſtice, about 9″; and to have receded as *much* from thoſe, that come with the Sun at the Summer-Solſtice.

Thus the *Phænomena* before recited are in general conformable to this Hypotheſis. But to be more particular; let *S* be the Place of a Star, *PS* the Circle of Declination paſſing thro' it, repreſenting its Diſtance from the mean Pole, and *γPS* its mean Right Aſcenſion. Then if *O* and *R* be the Points, where the Circle of Declination cuts the little Circle *ABCD*; the *true* Pole will be neareſt that Star at *O*, and fartheſt from it at *R*; the whole Difference amounting to 18″, or to the Diameter of the little Circle. As the true Pole of the Equator is ſuppoſed to be at *A*, when the Moon's Aſcending Node is in *Aries*; and at *B*, when that Node gets back to *Capricorn*; and the angular Motion of the true Pole about *P*, is likewiſe ſuppoſed equal to that of the Moon's Node about *E*, or the Pole of the Ecliptic: ſince, in theſe Caſes, the true Pole of the Equator is 90 Degrees before the Moon's Aſcending Node, it muſt be ſo in all others.



When the true Pole is at *A*, it will be at the ſame Diſtance from the Stars that lie in the Eqninoctial Colure, as the mean Pole *P* is; for I neglect at preſent the Caſe of ſuch Stars as are *very* near the Pole of the Equator; and as the true Pole recedes back from *A* towards *B*, it will approach the Stars, that lie in that Part of the Colure repreſented by *Pγ*; and recede from thoſe, that lie in *P*♎; not indeed

Indeed with an *equable* Motion; but in the *Ratio* of the *Sine* of the Diſtance of the Moon's Node from the Beginning of *Aries*. For if the Node be ſuppoſed to have gone backwards from *Aries* 30°, or to the Beginning of *Piſces*; the Point, which repreſents the Place of the true Pole, will in the mean time, have moved in the little Circle, thro' an Arc, as *AO*, of 30° likewiſe: and would therefore in Effect have approached the Stars that lie in the Equinoctial Colure ♈, and have receded from thoſe that lie in ♎, $4^{\prime}\frac{1}{2}$; which is the *Sine* of 30° to the *Radius AP*. For if a Perpendicular fall from *O* upon *PA*, it may be conceived as Part of a great Circle, paſſing thro' the true Pole and any Star lying in the Equinoctial Colure. Now the ſame Proportion, that holds in theſe Stars, will obtain likewiſe in all others; and from hence we may collect a general Rule, for finding how much nearer or farther, any particular Star is, to or from, the *mean* Pole, in any given Poſition of the Moon's Node.

For, if *from the Right-Aſcenſion of the Star, we ſubſtract the Diſtance of the Moon's Aſcending Node from Aries; then the Radius will be to the Sine of the Remainder, as* 9″, *is to the Number of Seconds, that the Star is nearer to, or farther from the True, than the Mean Pole.* When that Remainder is *leſs* than 180°, the Star is *nearer* to the True, than to the Mean Pole; and the contrary, when it is *greater* than 180°.

This Motion of the *true* Pole, about the *mean* at *P*, will alſo produce a Change in the Right Aſcenſions of the Stars, and in the Places of the Equinoctial Points; as well as in the Obliquity of the Eclip-

tic: and the Quantity of the Equations, in either of theſe Caſes, may be eaſily computed for any given Poſition of the Moon's Nodes. But as it may be needleſs, to dwell longer on the Explication of the Hypotheſis; I ſhall now proceed to ſhew its Correſpondency with the *Phænomena*, relating to the Alterations of the Polar Diſtances of ſome of the Stars which I have obſerved: by laying before your Lordſhip the Obſervations themſelves, together with the Computations that are neceſſary; in order to form a right Judgment about the Cauſe of theſe Appearances.

I have endeavoured to find the exact Quantity of the *mean* Preceſſion of the Equinoctial Points, by comparing my own Obſervations made at *Greenwich*, with thoſe of *Tycho Brahè* and others, which I judged to be moſt proper for that Purpoſe. But as many of the Stars, which I compared, gave a different Quantity; I ſhall aſſume the mean Reſult; which gives a Preceſſion of one Degree in ſeventy-one Years and an half: this agreeing very well likewiſe with my Obſervations that were taken at *Wanſted*. The Numbers in the following Tables, which expreſs the Change of Declination in each Star, are computed upon the Suppoſition, that the *mean* Obliquity of the Ecliptic was 23°. 28′. 30″, and that it continued the *ſame*, during the whole Courſe of my Obſervations. And as the Moon's Aſcending Node was in the Beginning of *Aries* about the 27th Day of *March* 1727, I have reduced the Place of each Star to *that* Time; by allowing the proper Change of Declination from that Day, to the Day of each reſpective Obſervation.

It being alſo neceſſary to make an Allowance for the *Aberrations* of Light; I have again examined my

my Obſervations, that were moſt proper to determine the Tranſverſe Axis of the Ellipſis, which each Star ſeems to deſcribe; and have found it to be neareſt to 40″; which Number I therefore make uſe of in the following Computations.

The Diviſions or Points upon the Limb of my Sector are placed five Minutes of a Degree from each other; and are numbered ſo, as to ſhew the Polar Diſtances nearly; the *true* Polar Diſtance exceeding that, which is ſhewn by the Inſtrument, about 1′. 35′. When I firſt began to obſerve, I generally made uſe of *that* Point on the Limb, which was neareſt to the Star's Polar Diſtance, without regarding whether it was more Northerly, or more Southerly than the Star: but as it ſometimes happened, that the Original Point, with which I at firſt compared the Star, became, in Proceſs of Time, pretty remote from it; I afterwards brought the Plummet to another Point, that was nearer to it; and carefully examined, what Number of Revolutions of the Screw of the Micrometer *&c.* correſponded to the Diſtance between the different Points, that I had made uſe of: by which means I was able to reduce all the Obſervations of the ſame Star to the ſame Point, without ſuppoſing the ſeveral Diviſions to be accurately 5′ aſunder.

I have expreſſed the Diſtance of each Star from the Point of the Arc, with which it was compared, in *Seconds* of a Degree and *tenth Parts* of a Second, exactly as it was collected from the Obſervations; altho I am ſenſible, that the Obſervations themſelves are liable to an Error of more than a *whole* Second; becauſe I meet with ſome, that have been made within two or three Days of each other, that differ 2″, even when they are not marked as *defective* in any reſpect.

It

It would be too tedious, to ſet down the whole Number of the Obſervations that I have made; and therefore I ſhall give only enough of them, to ſhew their Correſpondency with the foremention'd Hypotheſis in the ſeveral Years, wherein any were made of the Stars here recited. When *ſeveral* Obſervations have been taken of the ſame Star, within a few Days of each other; I have either ſet down the mean Reſult, or *that* Obſervation which beſt agreed with it. I have likewiſe commonly choſen thoſe, that were made near the ſame Seaſon of the Year, in ſuch Stars as gave me the Opportunity of making that Choice; particularly in *γ Draconis*, which was generally obſerved about the End of *Auguſt* or the Beginning of *September*; *That* being the uſual Time, when I went to *Wanſted* on purpoſe to obſerve both *that*, and alſo ſome of the Stars in the *great Bear*. But the Weather proving cloudy at that Seaſon in the Year 1744, prevented my making a ſingle Obſervation, either of *γ Draconis*, or any other Star, while I was there; which is the Cauſe of one Vacancy in a Series of 20 ſucceeding Years, wherein that particular Star had been obſerved. Such Stars, as were either not viſible in the Day-time, towards the Beginning of *September*, or came at ſuch Hours of the Night, as would have incommoded the Family of the Houſe wherein the Inſtrument is fixed, were but ſeldom obſerved, after I went to reſide at *Oxford:* which is the Reaſon, why the Series of Obſervations of *thoſe* is ſo imperfect, as ſometimes to leave a Chaſm for ſeveral Years together. But notwithſtanding this, I doubt not, but upon the whole they will be found ſufficient, to

ſatisfy

ſatisfie your Lordſhip of the general Correſpondency between the *Hypotheſis* and the *Phænomena*, in the ſeveral Stars; however different their Situations are, with reſpect to the Cardinal Points of the Equator.

As I made more Obſervations of *γ Draconis* than of any other Star; and it being likewiſe very near the Zenith of *Wanſted*; I will begin with the Recital of ſome of them. The Point upon the Limb, with which this Star was compared, was 38°. 25′ from the North Pole of the Equator, according to the Numbers of the Arc of my *Sector*. The firſt Column, in the following Table, ſhews the Year and the Day of the Month, when the Obſervations were made; the next gives the Number of *Seconds*, that the Star was found to be *South* of 38°. 25′: the third contains the Alterations of the Polar Diſtance, which the *mean* Preceſſion, at the rate of one Degree in 71½ Years, would cauſe in this Star, from the 27th Day of *March* 1727, to the Day on which the Obſervation was taken: the fourth ſhews the Aberrations of Light: the fifth, the Equations ariſing from the forementioned Hypotheſis: and the ſixth gives the *mean* Diſtance of the Star from the Point with which it was compared, found, by collecting the ſeveral Numbers, according to their Signs, in the 3d, 4th, and 5th Columns, and applying them to the *Obſerved Diſtances* contain'd in the Second.

If the Obſervations had been perfectly exact, and the ſeveral Equations of their *due* Quantity; then all the Numbers in the laſt Column would have been equal; but ſince they differ a little from one another; if the *mean* of All be taken, and and the Extremes are

pared with it, we ſhall find no greater Difference, than what may be ſuppoſed to ariſe from the Uncertainty of the Obſervations themſelves; it no where amounting to more than $1''\frac{1}{2}$. The Hypotheſis therefore ſeems, in this Star, to agree extremely well with the Obſervations here ſet down; but as I had made above 300 of it; I took the Trouble of comparing each of them with the Hypotheſis: and altho' it might have been expected, that, in ſo large a Number, ſome great Errors would have occurred; yet there are very few, *viz.* only eleven, that differ from the mean of theſe ſo much as $2''$; and not one that differs ſo much as $3''$. This ſurpriſing Agreement, therefore, in ſo long a Series of Obſervations, taken in all the various Seaſons of the Year, as well as in the different Poſitions of the Moon's Nodes, ſeems to be a ſufficient Proof of the Truth, both of *this* Hypotheſis, and alſo of *that* which I formerly advanced, relating to the Aberrations of Light; ſince the Polar Diſtance in this Star may differ, in certain Circumſtances, almoſt a Minute, *viz.* $56''\frac{1}{2}$, if the Corrections reſulting from both theſe Hypotheſes are neglected; whereas, when thoſe Equations are rightly applied, the mean Place of the Star comes out the ſame, as nearly, as can be reaſonably expected.

γ *Draconis*	South of 38. 25	Preceſſion.	Aberration.	Nutation.	Mean Diſt
	″	″	″	″	″
1727 September 3	70.5	— 0.4	+ 19.2	— 8.9	80.4
1728 March 16	108.7	— 0.8	— 19.0	— 8.6	80.3
September 6	70.2	— 1.2	+ 19.3	— 8.1	80.2
1729 March 6	108.3	— 1.6	— 19.3	— 7.4	80.0
September 8	69.4	— 2.1	+ 19.3	— 6.9	80.2
1730 September 8	68.0	— 2.9	+ 19.3	— 3.4	80.5
1731 September 8	66.0	— 3.8	+ 19.3	— 1.0	80.5
1732 September 6	64.3	— 4.6	+ 19.3	+ 2.0	81.0
1733 Auguſt 29	60.8	— 5.4	+ 19.0	+ 4.8	79.2
1734 Auguſt 11	62.3	— 6.2	+ 16.9	+ 6.9	79.9
1735 September 10	60.0	— 7.1	+ 19.3	+ 7.9	80.1
1736 September 9	59.3	— 8.0	+ 19.3	+ 9.0	79.6
1737 September 6	60.8	— 8.8	+ 19.3	+ 8.5	79.8
1738 September 13	62.0	— 9.6	+ 19.3	+ 7.0	78.7
1739 September 2	66.6	— 10.5	+ 19.2	+ 4.7	80.0
1740 September 5	70.8	— 11.3	+ 19.3	+ 1.9	80.7
1741 September 2	75.4	— 12.1	+ 19.2	— 1.1	81.4
1742 September 5	76.7	— 12.9	+ 19.3	— 4.0	79.1
1743 September 2	81.6	— 13.7	+ 19.1	— 6.4	80.6
1745 September 3	86.3	— 15.4	+ 19.2	— 8.9	81.2
1746 September 17	86.5	— 16.2	+ 19.2	— 8.7	80.8
1747 September 2	86.1	— 17.0	+ 19.2	— 7.6	80.7

I made about 250 Obſervations of β *Draconis*; which I find correſpond as well with the Hypotheſis, as thoſe of γ; but ſince the Poſitions of both theſe Stars, in reſpect to the Solſtitial Colure, differ but little from each other; it will be needleſs to ſet down the Obſervations of β. I ſhall therefore proceed to lay before your Lordſhip, ſome Obſervations of a ſmall Star, that is almoſt oppoſite to γ *Draco-*

conis in Right Aſcenſion, being the 35th *Camelopardali Hevel.* in the *Britiſh* Catalogue. Mr. *Flamſteed*, indeed, has not given the Right Aſcenſion of this Star; but *that* being neceſſary to be known, in order to compute the Change of its Declination ariſing from the Preceſſion of the Equinox; I compared the Time of its Tranſit over the Meridian, with that of ſome other Stars near the ſame Parallel; whereby I found, that its Right Aſcenſion was 85°. 54.′$\frac{1}{2}$ at the Beginning of the Year 1737.

This ſmall Star was compared with the ſame Point of the Limb of my Sector, as γ *Draconis*; and the ſecond Column, in the following Table, ſhews how many *Seconds* it was found to be South of that Point, at the time of each reſpective Obſervation. The other Columns contain, as in the foregoing Table, the Equations that are neceſſary to find, what its *mean* Diſtance from the ſame Point would have been on the 27th Day of *March* 1727, which is exhibited in the laſt Column. The whole Number of my Obſervations of this Star did not much exceed forty; the greateſt Part of which were made before the Year 1730; in ſome of the following Years none were taken; and only a ſingle one in any other, except in 1739. However, their Correſpondency ſeems ſufficient to evince the Truth of the Hypotheſis: for if the Mean of theſe, contain'd in the Table, be taken, not one, among the reſt of the Obſervations, will differ from it more than 2″.

35th *Camelopard. Hevelii.*	South on 0 ′ 38. 25	Preceſſion.	Aberration.	Nutation.	Mean Diſt. South.
	″	″	″	″	″
1727 October 20	73.6	+ 0.9	— 6.7	+ 8 9	76.7
1728 January 12	60.8	1.2	+ 6.1	8.8	76.9
March 1	57.8	1.4	+ 9.4	8.7	77.3
September 26	75.2	2.3	— 8.8	8 1	76.8
1729 February 26	56.4	2.8	+ 9.4	7.6	76.2
1730 March 3	57.8	4 4	9 4	5.4	77.0
1731 February 5	59.1	5.6	8.5	+ 3.0	76.2
1733 January 31	64 1	8.7	8 2	— 2.9	78.1
1738 December 30	61.8	17.2	4.3	6.5	76.8
1739 February 4	56.9	17.3	8 5	6 3	76.4
1740 January 20	56.0	18.6	7.0	— 4.0	77.6
1747 February 27	32.3	28.5	9.4	+ 8.4	78.6

The Obſervations of the foregoing Stars are the moſt proper, to prove the Change of the Inclination of the Earth's Axis to the Plane of the Ecliptic; thoſe, which follow, will ſhew in what manner the Stars, that lie near the Equinoctial Colure, are affected, as well as others, that are differently ſituated with reſpect to the Cardinal Points of the Equator. Some of theſe Stars are indeed more remote from the Zenith, than I would have choſen, if there had been others, of equal Luſtre, in more proper Poſitions; becauſe Experience has long ſince taught me, that the Obſervations of ſuch Stars, as lie near the Zenith, do generally agree beſt with one another, and are therefore the fitteſt to prove the Truth of any Hypotheſis. I ſhall begin with thoſe near the Vernal Equinox. *α Caſſiopeæ* was compared with the Point marked 34°. 55′; and at firſt was

was found to be more *Southerly*, but afterwards became more *Northerly* than that Point, as in the following Table; the laſt Column of which ſhews its mean Diſtance *South* of that Point on the 27th of *March* 1727. The Obſervation of the 23d Day of *December*, in the Year 1738, differs 3″ from the *mean* of the others; as does alſo another, that was taken five Days after this; neither of which being marked as uncertain, I judged it proper to inſert one of them; altho' they give the mean Place of the Star near 2 Seconds more *Northerly* than any other, in a Series of above 100; *all* of which correſpond, with the *mean* of theſe here recited, within leſs than 2″; excepting *two*, that give the Stars mean Diſtance almoſt 3″ more *Southerly*; but theſe laſt mentioned are marked as dubious; and indeed they appear to have been bad, by comparing them with ſeveral others, that were made near the ſame time, from which they differ almoſt 2″.

α *Caſſiopeæ.*	South of 34° 55′	Preceſſion.	Aberration.	Nutation.	Mean Diſt. South
	″	″	″	″	″
1727 September 9	55 0	+ 9.0	+ 2.2	+ 2 4	68.6
1728 September 17	30.8	29.4	+ 4.6	5.2	70.0
1729 June 8	35.7	43.8	— 16.3	6.8	70.0
December 3	N. 0 4	53.5	+ 16 5	7 7	68 2
1730 June 11	S. 13.8	64.0	— 16.2	8.4	70 0
December 9	N. 30.8	73.8	+ 16.3	8.8	68.1
1732 January 8	N. 49.2	95.4	12.9	8.9	68.0
1733 January 21	64.8	116.0	+ 10.0	7 0	69 1
1734 June 13	62.8	143.8	— 16.1	5 0	69.9
December 11	105 4	153.7	+ 16.2	+ 3 7	68.2
1738 December 23	176 3	234.0	+ 15 2	— 7.2	65.7
1740 June 2	169 1	262.8	— 16.5	— 8 9	68.3
1747 February 27	332.3	397.0	+ 0 2	+ 4.7	69.6

Altho'

Altho' I have taken no Obſervation of τ *Perſei* ſince the 22d Day of *January* 1740; yet, as this Star is very near the Zenith, and a ſufficient Number were made about the Times when the Equation, reſulting from the Hypotheſis, was at its *Maximum*; I judged it proper to inſert ſome of them in the next Table; the laſt Column of which ſhews, how much the Star's *mean* Diſtance was *South* of 38°. 20. on the 27th Day of *March* 1727. Among near 60 Obſervations I meet with two only, that differ from the mean of theſe ſo much as 2″; and thoſe differ almoſt as much from the mean of others, that were taken near the ſame time: ſo that the Hypotheſis ſeems to correſpond, in general, with the Obſervations of this Star as well, as with either of the foregoing.

τ *Perſei*.	South of 38. 20	Preceſſion.	Aberration.	Nutation.	Mean Diſt. South.
	″	″	″	″	″
1727 September 16	60.1	+ 7.4	− 3.2	+ 6.7	71.0
December 29	39.7	11.9	+ 12.9	7.2	71.7
1728 December 21	22.5	27.2	12.8	8.7	71.2
1729 December 2	S. 9.2	42.0	11.5	9.0	71.7
1731 January 3	N. 8.2	59.0	12.8	8.3	71.9
1732 January 8	22.0	74.8	12.7	6.7	72.2
1733 January 21	34.6	91.0	11.7	+ 4.3	72.4
1738 December 23	117.0	183.4	12.8	− 9.0	70.2
1740 January 22	132.5	200.2	11.7	8.6	70.8

After the laſt recited Obſervations, it may perhaps ſeem needleſs to add thoſe of α *Perſei*, which is farther from the Zenith; but however, as this Star lies very nearly at an equal Diſtance from the Equinoctial

Equinoctial and Solſtitial Colures, and the Series of Obſervations of it is ſomewhat more complete, than that of *τ Perſei*; I ſhall inſert one at leaſt, for each Year wherein it has been obſerved; whereby it may appear, that the Hypotheſis ſolves the *Phænomena* of Stars in this Situation, as exactly as in others: for if a *mean* be taken of the Numbers in the laſt Column of the following Table, which expreſſes the *mean* Diſtance of the Star *South* of 41°. 5′. on *March* 27th 1727, it will agree within two Seconds, with every one of 80 Obſervations, that have been made of this Star.

α Perſei	South of ° ′ 41. 5	Preceſſion.	Aberration.	Nutation	Mean Diſt. South.
	″	″	″	″	″
1727 December 29	79.4	+ 10.5	+ 11.4	+ 7.9	109.2
1728 April 7	87.5	14.3	— 0.8	8.2	109.2
July 5	94.6	17.7	— 11.4	8.5	109.4
December 13	65.7	23.8	+ 10.6	8.8	108.9
1729 December 3	53.4	37.2	9.7	8.9	109.2
1731 January 3	38.6	52.3	11.4	7.8	110.1
1732 January 8	26.8	66.2	+ 11.4	+ 5.9	110.3
1734 July 11	S. 21.3	101.0	— 11.4	— 1.1	109.8
1738 December 24	N. 50.3	162.6	+ 11.2	9.0	108.5
1740 January 21	71.8	177.4	10.9	— 8.2	108.3
1747 February 27	182.5	275.4	6.6	+ 8.5	108.0

Having already given Examples of Stars, lying near both the Solſtices and the *Vernal* Equinox; I ſhall now add the Obſervations of *one*, that is not far from the *Autumnal* Equinox, *viz. η Urſæ Majoris*, the brighteſt Star in that Part of the Heavens, which approaches the Zenith of *Wanſted* within a Degree; and

and which, by reaſon of its Luſtre and Poſition, gave me the Opportunity of making my Series of Obſervations of *It*, more complete than of many others. This Star was compared with the Point marked 39°. 15′. and was *South* of it as in the following Table; wherein your Lordſhip will ſee, that the Obſervations of the Years 1740 and 1741 give the Polar Diſtances 3″ greater, than the *mean* of the other Years. Had there been only a ſingle Obſervation taken in either of thoſe Years, Part of this apparent Difference might have been ſuppoſed to ariſe from their Uncertainty; but as there were 8 Obſervations taken within a Week, either before or after the 3d Day of *June* 1740, which agree well with each other; and three were made within 20 Days in *September* 1741, which likewiſe correſponded with each other; I am inclined to think, that the 'forementionʼd Differences muſt be owing to ſomething elſe, beſides the Error of the Obſervations. This *Phænomenon* therefore may deſerve the Conſideration of thoſe Gentlemen, who have employed their Time in making Computations relating to the Quantity of the Effects, which the Power of Gravity may, on various Occaſions, produce. For I ſuſpect, that the Poſition of the Moon's Apogee, as well as of her Nodes, has ſome Relation to the apparent Motions of the Stars that I am now ſpeaking of.

My Series of Obſervations of ſeveral Stars abound, of late Years, with ſo many and long Interruptions; that I cannot pretend to *determine* this Point; but probably the Differences before taken notice of in the Obſervations of α *Caſſiopeæ*, and ſome others

that I have found likewiſe among the Obſervations of *other* Stars, that are not here recited, may be owing to ſuch a Cauſe; which, altho' it ſhould not have any large Share of Influence, may yet, in certain Circumſtances, diſcover a Defect in a Hypotheſis, that pays no Regard at all to *It*. But whether theſe Differences do ariſe from the Cauſe already hinted at; or whether they proceed from any Defect of the Hypotheſis itſelf in any other reſpect; it will not be very *material* in point of Practice; ſince *that* Hypotheſis, as it was before laid down, appears to be ſufficient to ſolve all the *Phænomena*, to as great a Degree of Exactneſs, as we can in general *hope* or *expect* to make Obſervations. For if I take the *mean* of all the Numbers in the laſt Column of the following Table for η *Urſæ Majoris*, and compare it with any one of 164 Obſervations that were taken of it, the Difference will not exceed three Seconds.

η *Urſæ Majoris*		South of ○ ′ 39. 15	Preceſſion.	Aberration.	Nutation	Mean Diſt. South
		″	″	″	″	″
1727 October	17	153.3	— 10.2	+ 1.0	— 5.2	138 9
1728 January	24	176.4	15.2	— 17.6	5.8	137 8
July	17	150.8	23.9	+ 17.8	6.9	137.8
October	11	170.6	28.2	+ 2.6	7.3	137.7
1729 January	16	196.6	33.1	— 17.8	7.8	137.9
July	21	170.4	42.4	+ 17.8	8.4	137.4
1730 July	19	189.6	60.6	+ 17.8	9.0	137.8
December	28	232.4	68.7	— 16.7	8.9	138 1
1731 September	16	218.1	81.9	+ 9.4	8.4	137.2
1732 January	10	250.7	87.7	— 17.7	8 0	137.3
April	13	238.7	92.3	— 0.8	7.7	137.9
1734 July	11	255.7	133.3	+ 17.6	— 2.3	137.7

η *Urſæ*

η *Urſæ Majoris*	South of ° ′ 39. 15	Preceſſion.	Aberration.	Nutation	Mean Diſt. South
	″	″	″	″	″
1735 September 10	280.8	154.6	+ 11.4	+ 1.2	138.8
1736 September 8	294.7	172.8	11.6	4.1	137.6
1737 July 3	303.0	187.8	17.2	6.1	138.5
1738 June 29	319.0	205.8	16.8	7.9	137.9
1739 April 25	348.0	220.8	2.5	8.8	138.5
1740 June 3	360.3	241.1	12.8	8.9	140.9
1741 September 23	390.9	265.0	7.9	+ 7.4	141.2
1745 September 5	466.7	337.1	12.4	— 3.3	138.7
1746 September 20	492.0	356.2	8.8	5.9	138.7
1747 September 2	507.2	373.5	13.2	7.8	139.1

You may perceive, my Lord, by inſpecting the Tables which contain the Obſervations of α *Caſſiopeæ* and η *Urſæ Majoris*; that the greateſt Differences that occur therein may be diminiſhed, by ſuppoſing the *true* Pole of the Equator to move round the Point *P*, in an *Ellipſis*, inſtead of a Circle. For if the tranſverſe Axis, lying in the Direction *AC*, be 18″, and the Conjugate, as *DB*, be about 16″; the Equations, reſulting from ſuch an Hypotheſis, will make the Numbers in the laſt Columns agree with each other, nearer than as they now ſtand. But ſince this would not entirely remove the Inequalities, in all the Poſitions of the Moon's Nodes; I ſhall refer the more accurate Determination of the *Locus* of the *true* Pole to Theory; and at preſent only give the Equations for the Preceſſion of the Equinoctial Points, and the Obliquity of the Ecliptic, as alſo the real Quantity of the annual Preceſſion, to every 5th Degree of the Place of the Moon's Aſcending Node, in the following Tables; juſt as

they reſult from the Hypotheſis, as at firſt laid down; it appearing, from what has already been remark'd, that theſe will be ſufficiently exact for Practice in all Caſes.

The Equation of the Equinoct. Points

☊ from ♈	Sig O	I	II	Subtr.
	Sig VI	VII	VIII	Add
°	″	″	″	°
0	0.0	1 2	1 9 6	30
5	2 0	1 3 0	2 0.5	25
10	3.9	1 4 5	2 1.2	20
15	5 8	1 6.0	2 1 8	15
20	7.7	1 7.3	2 2.2	10
25	9 6	1 8.5	2 2.5	5
30	1 1 3	1 9.6	2 2.6	0
Subtr.	Sig V	IV	III	☊ from ♈
Add	Sig. XI	X	IX	

The Equation of the Obliquity of the Ecliptick.

☊ from ♈	Sig O	I	II	Add
	Sig. VI	VII	VIII	Subtr.
°	″	″	″	°
0	9.0	7.8	4.5	30
5	9 0	7.4	3 8	25
10	8.9	6.9	3.1	20
15	8 7	6 4	2.3	15
20	8 5	5.8	1.6	10
25	8.2	5.2	0.8	5
30	7.8	4 5	0 0	0
Add	Sig. V	IV	III	☊ from ♈
Subtr.	Sig. XI	X	IX	

The Annual Preceſſion of the Equinoctial Points.

☊ from ♈	Sig. O	I	II	III	IV	V	
	″	″	″	″	″	″	°
0	58.0	57.0	54.2	50.3	46.5	43.7	30
5	57.9	56.6	53.6	49.7	46.0	43.4	25
10	57 9	56.2	53.0	49.0	45.5	43.2	20
15	57.7	55.7	52 3	48.4	45.0	43.0	15
20	57.5	55.2	51.7	47.7	44.5	42.8	10
25	57.3	54.7	51.0	47.1	44.1	42.8	5
30	57.0	54.2	50.3	46.5	43.7	42.7	0
	Sig. XI	X	IX	VIII	VII	VI	☊ from ♈

Sir

Sir *Iſaac Newton*, in determining the Quantity of the annual Preceſſion from the Theory of Gravity, upon Suppoſition that the Equatorial is to the Polar Diameter of the Earth as 230 is to 229, finds the Sun's Action ſufficient to produce a Preceſſion of $9''\frac{1}{2}$ only; and, collecting from the Tides the Proportion between the Sun's Force and the Moon's to be as 1 to $4\frac{1}{2}$, he ſettles the mean Preceſſion, reſulting from their joint Actions, at 50″. But ſince the Difference between the Polar and Equatorial Diameter is found, by the late Obſervations of the Gentlemen of the *Academy of Sciences*, to be greater than what Sir *Iſaac* had computed it to be; the Preceſſion, ariſing from the Sun's Action, muſt likewiſe be greater than what he has ſtated it at, nearly in the ſame Proportion. From whence it will follow, that the Moon's Force muſt bear a leſs Proportion to the Sun's than $4\frac{1}{2}$ to 1; and perhaps the *Phænomena*, which I have now been giving an Account of, will ſupply the beſt *Data* for ſettling this Matter.

As I apprehend, that the Obſervations already ſet down will be judged ſufficient, to prove in general the Truth of the Hypotheſis before advanced; I ſhall not trouble your Lordſhip with the Recital of more, that I made of Stars lying at greater Diſtances from the Zenith; thoſe not being ſo proper, for the Reaſon before-mention'd, to eſtabliſh the Point that I had chiefly in View. But as it may perhaps be of ſome Uſe to future Aſtronomers, to know what were the *mean* Differences of Declination, at a given Time, between ſome Stars, that lie nearly oppoſite to one another in Right Aſcenſion, and not far from either of the *Colures*; I ſhall ſet down the Reſult of the Compariſon of a few, that differ ſo little in Declination, that

that I could determine the Quantity of that Difference with great Certainty.

By the *mean* of 64 Obſervations, that were made of α *Caſſiopeæ* before the End of the Year 1728, I collect, after allowing for the Preceſſion, Aberration and Nutation as in the foregoing Tables; that the *mean* Diſtance of this Star was 68″.7 South of 34°. 55′, on the 27th Day of *March* 1727. By a like Compariſon of 40 Obſervations, taken of γ *Urſæ Majoris* during the ſame Interval of Time, I find this Star was, at the ſame time, 39″.6 South of 34°. 45′. I carefully meaſured, with the Screw of the Micrometer, the Diſtance between the Points, with which theſe Stars were compared; and found them to be 9′. 59″ from each other, or one Second leſs than they ought to have been. Hence it follows, that the *mean* Difference of Declination between theſe two Stars, was 10′. 28″.1, on the 27th Day of *March* 1727.

By the *mean* of 65 Obſervations, that were taken of β *Caſſiopeæ*, before the End of the Year 1728, this Star was 25″.8 North of 32°. 20′, on the 27th Day of *March* 1727: and by the *mean* of 52 Obſervations, ε *Urſæ Majoris* was 87″.6 South of 32°. 30′ at the ſame time. The Diſtance between theſe Points was found to be 9′. 59′.3; from whence it follows, that the *mean* Difference of Declination between theſe two Stars was 11′. 52″.7 on *March* 27th 1727.

By the *mean* of 100 Obſervations, taken before the End of the Year 1728, the *mean* Diſtance of γ *Draconis* was 79″.8 South of 38°. 25′ on *March* 27th 1727; and by the *mean* of 35 Obſervations, the

the 35th *Camelopard. Hevel.* was South of the ſame Spot 76″.4. So that the mean Polar Diſtance of γ *Draconis* was only 3″.4 greater, than that of the 35th *Camelopard. Hevel.* but as the Equation for the Nutation, in both theſe Stars, was then near the *Maximum*, and to be applied with contrary Signs; the *Apparent* Polar Diſtance of γ *Draconis* was 21″.4 greater, on the 27th Day of *March* 1727.

The Differences of the Polar Diſtances of the Stars, as here ſet down, may be preſumed, both on account of the Radius of the Inſtrument and the Number of Obſervations, to be very exactly determined, to the Time when the Moon's Aſcending Node was at the Beginning of *Aries*; and if a like Compariſon be hereafter made, of Obſervations taken of the ſame Stars, near the ſame Poſition of the Moon's Nodes; future Aſtronomers may be enabled, to ſettle the Quantity of the mean Preceſſion of the Equinox, ſo far as it affects the Declination of theſe Stars, with great Certainty: and they may likewiſe diſcover, by means of the Stars near the Solſtitial Colure, from what Cauſe the apparent Change in the Obliquity of the Ecliptic really proceeds, if the mean Obliquity be found to diminiſh gradually.

The foremention'd Points indeed can be ſettled only on the Suppoſition, that the angular Diſtances of theſe Stars do continue always the ſame, or that they have no real Motion in themſelves; but are at Reſt in Abſolute Space. A Suppoſition, which though uſually made by Aſtronomers, nevertheleſs ſeems to be founded on too uncertain Principles, to be admitted in all Caſes. For if a Judgment may be formed, with Regard to this Matter, from the Re-

ſult

ſult of the Compariſon of our beſt modern Obſervations, with ſuch as were formerly made with any tolerable Degree of Exactneſs; there appears to have been a real Change in the Poſition of ſome of the fixed Stars, with reſpect to each other; and ſuch, as ſeems independent of any Motion in our own Syſtem, and can only be referred to ſome Motion in the Stars themſelves. *Arcturus* affords a ſtrong Proof of this: for if its preſent Declination be compared with its Place, as determined either by *Tycho* or *Flamſteed*; the Difference will be found to be much greater, than what can be ſuſpected to ariſe from the Uncertainty of their Obſervations.

It is reaſonable to expect, that other Inſtances of the like kind muſt alſo occur among the great Number of the viſible Stars: becauſe their relative Poſitions may be alter'd by various means. For if our own Solar Syſtem be conceived to change its Place, with reſpect to Abſolute Space; this might, in Proceſs of Time, occaſion an apparent Change in the angular Diſtances of the fixed Stars; and in ſuch a Caſe, the Places of the neareſt Stars being more affected, than of thoſe that are very remote; their relative Poſitions might ſeem to alter; tho' the Stars themſelves were really immoveable. And on the other Hand, if our own Syſtem be at Reſt, and any of the Stars really in Motion, this might likewiſe vary their apparent Poſitions; and the more ſo, the nearer they are to us, or the ſwifter their Motions are, or the more proper the Direction of the Motion is, to be rendered perceptible by us. Since then the Relative Places of the Stars may be changed from ſuch a Variety of Cauſes, conſidering that amazing Diſtance

tance at which it is certain ſome of them are placed, it may require the Obſervations of many Ages, to determine the Laws of the apparent Changes, even of a ſingle Star: much more difficult therefore muſt it be, to ſettle the Laws relating to all the moſt remarkable Stars.

When the Cauſes, which affect the Places of all the Stars in general are known; ſuch as the Preceſſion, Aberration, and Nutation; it may be of ſingular Uſe, to examine nicely the relative Situations of particular Stars: and eſpecially of thoſe of the greateſt Luſtre, which, it may be preſumed lie neareſt to us, and may therefore be ſubject to more ſenſible Changes; either from their own Motion, or from that of our Syſtem. And if at the ſame time that the brighter Stars are compared with each other, we likewiſe determine the relative Poſitions of ſome of the *ſmalleſt* that appear near them, whoſe Places can be aſcertained with ſufficient Exactneſs; we may perhaps be able to judge to what Cauſe the Change, if any be obſervable, is owing. The Uncertainty that we are at preſent under, with reſpect to the Degree of Accuracy wherewith former Aſtronomers could obſerve, makes us unable to determine ſeveral Things, relating to the Subject that I am now ſpeaking of: but the Improvements, which have of late Years been made in the Methods of taking the Places of the heavenly Bodies, are ſo great, that a few Years may hereafter be ſufficient, to ſettle ſome Points; which cannot now be ſettled, by comparing even the earlieſt Obſervations with thoſe of the preſent Age.

It were to be wiſh'd therefore, that ſuch Perſons as are provided with proper Inſtruments, would attempt to determine, with great Care, the preſent relative Poſitions of ſeveral of the Principal Stars, in various Parts of the Heavens; eſpecially of thoſe, that are leaſt affected by Refraction: *that* Cauſe having many times ſo uncertain an Influence on the Places of Objects, that are very remote from the Zenith; that wherever *It* is concerned, the Concluſions, deduced from Obſervations that are *much* affected by it, will always remain doubtful, and too precarious, in many Caſes, to be relied upon.

The Advantages, ariſing from different Perſons attempting to ſettle the ſame Points of Aſtronomy near the ſame time, are ſo much the greater; as a Concurrence in the Reſult, would remove all Suſpicion of Incorrectneſs in the Inſtruments made uſe of. For which Reaſon, I eſteem the curious *Apparatus* at *Shirburn Caſtle*, and the Obſervations there taken, as a moſt valuable *Criterion*, whereby I may judge of the Accuracy of thoſe, that are made at the *Royal Obſervatory*: and as a Lover of Science I cannot but wiſh, that our Nation abounded with more frequent Examples, of Perſons of like Rank and Ability with your Lordſhip, equally deſirous of promoting *This*, as well as every other Branch of Natural Knowledge, that tends to the Honour and Benefit of our Country.

But were the Patrons of Arts and Sciences ever ſo numerous, the Subject of my preſent Letter is of ſuch a Nature, as muſt direct me, to beg Leave to addreſs it to the *Earl of Macclesfield*; not only as a moſt competent Judge of it; but as the *ſole* Perſon,

ſon, in this Nation, that hath Inſtruments proper to examine into the Truth of the Facts here related. And it is a particular Satisfaction to me, that after ſo long an Attendance upon theſe *Phænomena*, I am allowed the Honour of tranſmitting the Account of them to the Public, thro' your Lordſhip's Hands: as it gives me at the ſame time an Opportunity of profeſſing the grateful Senſe I ſhall ever retain, both of the ſignal Favours which I formerly received from the noble Earl your Father, and of the many recent Obligations conferr'd by yourſelf upon,

My LORD,

Your Lordſhip's

moſt obedient

humble Servant,

Greenwich. Dec. 31. 1747.

Ja. Bradley.

Florian Cajori [1] 1859-1930

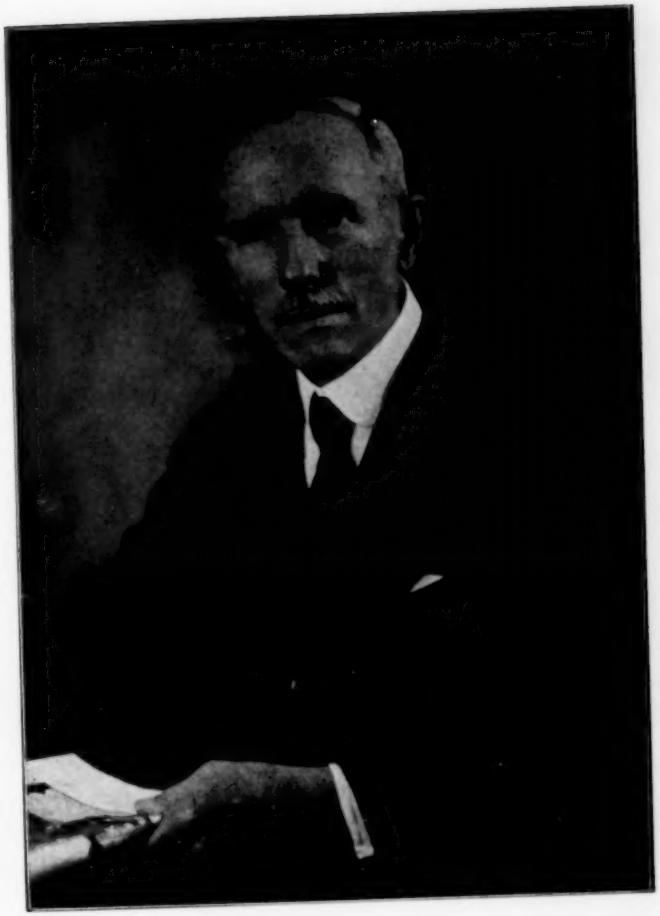
FLORIAN CAJORI, professor emeritus of mathematics at the University of California, died at his home in Berkeley, 14 August 1930, after a brief attack of pneumonia, in the seventy-second year of his age. For forty years his name had been a familiar one throughout the world, recalling a genial personality and a prolific writer on various topics connected with the history of mathematics and physics.

He was born at St. Aignan near Thusis, Switzerland, 28 February 1859. His mother was CATHERINE (CAMENISCH), and his father was GEORG CAJÖRI (the family name was spelled thus, or as CAJOERI (2)), an engineer and contractor, well known in his part of Switzerland for important bridges and highways that he built.

Professor CAJORI received his early education at Zillis, and in the canton school at Chur. At the age of 16 years he came to America, an elder brother having preceded him, and made his way at once to Whitewater, Wisconsin, where he continued his education at the normal school during the years 1876-78. After some teaching in a country school he entered the University of Wisconsin where he received the degrees of Bachelor of Science in 1883, and of Master of Science in 1886. From January 1884 to June 1885 he was a graduate student of mathematics at The Johns Hopkins University, and received his first academic appoint-

(1) Published sources of information concerning Professor CAJORI are : *American Men of Science*, fourth ed., New York, 1927. *Who's Who in America*, v. 16 (1930-1931). L. G. SIMONS, *Amer. Math. Mo.*, v. 37, Nov. 1930, p. 460-462. D. E. SMITH : (a) *Science*, n.s., v. 72, 19 Sept. 1930, p. 287-288 ; (b) Amer. Math. So., *Bull.*, v. 36, Nov. 1930, p. 777-780, portrait ; (c) *Archeion, Archivio di Storia della Scienza*, v. 12, 1930, p. 369-371.

(2) Compare the article « Cajoeri » in *Dictionnaire Historique & Biographique de la Suisse*, v. 2, Neuchatel, 1924, an old family whose members were formerly free men of the church, and hereditary fief holders. Among these is more than one named FLURIN of Zillis, the dates for the last of whom were 1840-1918.



FLORIAN CAJORI
(1859-1930)

R. C. ARCHIBALD

ment in the following autumn. This was at Tulane University, New Orleans where he was an assistant professor of mathematics 1885-87, and professor of applied mathematics 1887-88. Since, on account of his health, a change of climate seemed very desirable, he spent the next year in collecting material for a forthcoming work and accepted a position at Colorado College, Colorado Springs, where he was first a professor of physics 1889-98, then professor of mathematics 1898-1918, and dean of the department of engineering 1903-18. During these twenty-nine years not only did he always carry a heavy teaching load, but also served in various administrative capacities for which he was ideally qualified. But in spite of all such demands upon his time, even though far removed from adequate library facilities, he achieved a remarkable quantity of publication. Throughout life he possessed to an extraordinary degree the ability to utilize every spare minute, taking up intensively at a moment's notice the consideration of any particular question. He was greatly interested in college athletics and followed enthusiastically both the regular and practice games, especially in football. He always walked a great deal in the mountains near Colorado Springs, and later, to a more limited extent, in the Berkeley Hills.

What was his scientific status before 1918? In 1890 the Bureau of Education at Washington published his very interesting 400-page work on *The Teaching and History of Mathematics in the United States*, the preparation of which called for a great amount of careful research. In 1894 appeared the equally extensive *History of Mathematics* (19) (3) and in this year Tulane University awarded him the degree of Doctor of Philosophy. This *History* gave the most extensive and useful account in English of the history of mathematics in the nineteenth century. In 1899 appeared the first edition of *A History of Physics in its Elementary Branches including the Evolution of Physical Laboratories* (30), of which there were later two Italian editions; in 1904 *An Introduction to the Modern Theory of Equations* (45); in 1908 the excellent 160-page section on « Arithmetik. Algebra. Zahlentheorie » (63) in volume 4 of CANTOR's great work *Vorlesungen über Geschichte der Mathematik;* in 1909 *A History of the Logarithmic Slide Rule*

(3) Number in the list of publications with which this memoir concludes.

and Allied Instruments (69); and in 1916 the interesting little work *William Oughtred. A great Seventeenth-century Teacher of Mathematics* (123). The University of Colorado awarded him the degree of Doctor of Laws in 1912, and Colorado College did the same in 1913, the year in which the University of Wisconsin also made him a Doctor of Science. He was president of the Mathematical Association in 1917. Among other items of the 127 titles of publications before 1918 are 4 volumes of elementary texts (102, 112, 113, 114) and a number of papers of much interest and value. These include the extended and admirable « history of the exponential and logarithmic concepts » (92) and « history of ZENO's arguments on motion » (103), « a history of the arithmetical methods of approximation to the roots of numerical equations of one unknown quantity » (80), and « CARL FRIEDRICH GAUSS and his children » (28, 89) containing information not readily available elsewhere in print till MACK's recent volume (28). There are also several non-historical papers on series (15, 16, 18, 21, 24, 36, and 40).

With such a record to his credit the University of California but extended her own prestige by appointing FLORIAN CAJORI, 1 July 1918, professor of the history of mathematics, one of the few chairs of the kind in the world. Freed at last from all administrative duties, and enthusiastic over the opportunity presented for devoting all of his energies to the problems of teaching, research, and publication in the field which he loved, his productivity increased by leaps and bounds; 159 notes, papers, memoirs, and books are assignable to the twelve years in California. Since he became professor emeritus 1 July 1929 he was then freed from teaching obligations, and was thus enabled to proceed with even greater singleness of purpose to draw upon the accumulated stores of his erudition. But an illness resulting in a serious operation occured in February 1930, and greatly sapped his vitality.

During this California period CAJORI's most notable publications were in connection with mathematical notations, the history of various matters connected with the calculus, fluxions, and partial differential equation, and work of NEWTON. His monumental work on *Mathematical Notations* (261), original in conception, must be of enduring value. Three somewhat extensive and

interesting papers may be mentioned along with this, namely: « The history of notations of the calculus » (192), « LEIBNIZ, the master builder of mathematical notations » (219), and « A list of OUGHTRED's symbols with historical notes » (141).

Another important book was his *History of the Conceptions of Limits and Fluxions in Great Britain from Newton to Woodhouse* (138) published shortly after going to California. With this may be coupled « Grafting the theory of limits on the calculus of LEIBNIZ » (191), « NEWTON's fluxions » (258), and « The early history of partial differential equations and of partial differentiation and integration » (252) of which a Spanish translation (252*a*) was also published.

As to further work of NEWTON CAJORI's discussion of the question of the « twenty years' delay in announcing the law of gravitation » (257), read at the NEWTON bicentenary celebration, was complete and satisfying. For many years CAJORI had talked of bringing out a new edition of NEWTON's *Principia* with notes (285). The older translations of MOTTE and THORP were difficult of access, and left much to be desired. It was therefore with great satisfaction that his colleagues learned that the complete manuscript, ready for the printer, was found among his papers. This is about to be published by the University of California (4). CAJORI left also the complete manuscript for a new edition of NEWTON's *Opticks* (286) the publication of which had been arranged (5)

Three other books published during the last years of his life may be referred to. One on *Mathematics as a Liberal Education* (256) was a critical examination of the judgements of prominent men of the ages from the Greek period to the twentieth century. The second was a biography of one of Professor CAJORI's fellow countrymen, FERDINAND RUDOLPH HASSLER (278), the first superintendent of the United States Coast Survey; it is a valuable and interesting work, containing much new material from manuscript sources. In the third book, on *Early Mathematical Sciences in*

(4) Professors M. W. HASKELL ,R. T. CRAWFORD, and H. M. EVANS constituted the committee of publication on the request of Mrs. CAJORI and her son.

(5) Unfortunately the publication now seems improbable since a cheap reprint of the fourth edition was published by BELL & SONS, London, 1931, with a Foreword by A. EINSTEIN and an Introduction by E. T. WHITTAKER.

North and South America (255), are assembled, with interesting illustrations and in very useful form, many facts concerning astronomy, physics, and mathematics, and societies, academies and journals,—of an earlier day.

While the « List of Professor CAJORI's Publications » which follows contains a very large number of titles it is to be borne in mind that a considerable part of these are of small scientific consequence; this is true of most of the 53 reviews; of the many notes concerning discoveries of others; of many brief personal notes and controversies, and of many variants of the same theme. Of course no one realized this more than Professor CAJORI himself. Under date 8 August 1921 he wrote as follows :

« If the principal papers which I have contributed to periodicals were to be collected and republished, in one volume, this volume should include the following forty numbers (6) :

14, 18, 26, 28, 36, 53, 54, 65, 74, 75, 79, 80, 82, 83, 84, 89, 90, 91, 92, 96, 99, 100, 101, 103, 104, 105, 106, 111, 120, 127, 128, 130, 132, 140, 146, 148, 154, 156, 157, 159. »

Many of Professor CAJORI's publications, especially in the pre-Californian days, show evidence both of haste in composition and of lack of checking in proof with his sources of information. This was generally doubtless due to exigencies under which he was compelled to work. His English style lacked in graces to make it especially attractive, even though his elaboration of matters under discussion was always singularly clear. He did comparatively little work with manuscript source material; practically all of his discussions were with reference to printed documents. But in this respect he performed great services. Hundreds of points, and scores of connected accounts of topics, will hereafter be noted and have their proper settings, because of his presentations of the facts.

Supplementary to our earlier list of extra-academic honors it may be noted that Professor CAJORI was vice-president of the American Association for the Advancement of Science and chairman of Section L (Historical and Philological Sciences) in 1923; vice-president of the History of Science Society in 1924-25; and

(6) The actual numbers in Professor CAJORI's list were entirely different from those given here but the titles are the same.

vice-president of the Comité International d'Histoire des Sciences in 1929-30.

During the period at Tulane University he made the acquaintance of Miss ELIZABETH G. EDWARDS, of St. Louis, who was teaching at Newcomb College. They were married in 1890, and their son FLORIAN ANTON is assistant professor of physiological chemistry in the Medical School of the University of Pennsylvania.

Professor CAJORI was a man, exceeding modest in bearing, lofty in his ideals as to personal conduct and as to the search for scientific truths, especially endowed with good judgment, blessed with the most gentle kindliness of spirit and with intense interest in others and their problems, and a man who could be the finest of friends. The memory of the beauty of his personality lingers as a precious, fragrant, and inspiring possession of hosts of his students and friends, left behind for a space.

LIST OF PROFESSOR CAJORI'S PUBLICATIONS

1. Note on a quadratic form.
John Hopkins Univ. Circ., v. 4, n. 41, July 1885, p. 122.
2. (a) Non-euclidean geometry; (b) Classification of geometry; (c) Geometrical trinity.
Journal of Education, New Orleans, (a) v. 7, Dec. 1885, p. 230-232; (b) v. 7, Feb. 1886, p. 292-294; (c) v. 8, Mar. 1886, p. 12-14.
3. History of Arabic notation.
Journal of Education, New Orleans, v. 8, Nov. 1886, p. 201-203; Dec. 1886, p. 225-228.
4. History of decimal fractions.
Journal of Education, New Orleans, v. 9, Nov. 1887, p. 170-173.
5. History of infinite series.
New Orleans Acad. Sci., *Papers*, v. 1, no. 2, 1888, p. 22-43.
The author's name is here spelled CAJÖRI.
6. Difference between Napier's and natural logarithms.
Mathematical Magazine, v. 2, Jan. 1890, p. 1-3.
7. Differentiation of a Logarithm.
Mathematical Magazine, v. 2, Oct. 1890, p. 60.
Compare no. 12.

8. *The Teaching and History of Mathematics in the United States.*
Washington, D. C., 1890, 400 p.
Bureau of Education, Circular of Information, no. 3.

9. A mathematical text-book of the last century. [John Ward's *Young Mathematician's Guide*].
Colorado College Studies, v. 1, 1890, p. 27-33.

10. The rise of mathematics in the United States.
Education, v. 12, Nov. 1891, p. 170-175.

11. The study of Diophantine analysis in the United States.
Colorado College Studies, v. 2, 1891, p. 39-47.

12. Historical note on the differentiation of a logarithm.
Colorado College Studies, v. 2, 1891, p. 96.
Compare no. 7.

13. A mathematical error in the *Century Dictionary*.
Colorado College Studies, v. 2, 1891, p. 97.

14. Historical sketch of the study of mathematics in the United States.
Bibliotheca Mathematica, s. 2, v. 5, 1891, p. 74-78.

15. Multiplication of series.
N. Y. Math. So., *Bull.*, v. 1, May 1892, p. 184-189.

16. Evolution of criteria of convergence.
N. Y. Math. So., *Bull.*, v. 2, Oct. 1892, p. 1-10.

17. Draper's barograph.
Colorado College Studies, v. 3, 1892, p. 52-54.

18. On the multiplication of semi-convergent series.
Amer. Jl. Math., v. 15, 1893, p. 339-343.

19. *A History of Mathematics.*
New York, 1894, 14+422 p.
Second ed. rev. and enl., New York, 1919, 8+516 p.

20. Was the binomial theorem engraven on Newton's monument?
Amer. Math. So., *Bull.*, v. 1, Nov. 1894, p. 52-54.

21. The multiplication of semi-convergent series.
Amer. Math. So., *Bull.*, v. 1, Apr. 1895, p. 180-183.

22. Coin distortions by Röntgen rays.
Science, n.s. v. 3, 24 Apr. 1896, p. 635.

23. Darkening of a cathode in a Crookes tube.
Science, n.s., v. 3, 19 June 1896, p. 901.
By F. Cajori and W. Strieby.

24. On the multiplication and involution of semi-convergent series.
Amer. Jl. Math., v. 18, 1896, p. 195-209.

25. *A History of Elementary Mathematics with Hints on Methods of Teaching.*
New York, 1896, 8+304 p.

Reprinted Aug. 1897; Mar. 1905; Oct. 1907; Aug. 1910; Feb. 1914.

Revised and enlarged edition. New York, 1917, 8+324 p.

25*a*. Russian translation with remarks and additions by I. U. TIMCHENKO, Odessa, 1910, 10+368 p. Preface of the editor p. III-IV.

25*b*. Japanese translation, by KINOSUKE OGURA and YAMON IDE, revised by YOSHIO MIKAMI, Tokyo, 1928, 11+11+511 p.

There are over 170 added illustrations. The preface by CAJORI is dated April, 1928. The volume is number 6 in the series: Collection of famous teachers of mathematics.

26. Search for solar x-rays on Pike's Peak.

Amer. Jl. Science, s. 4, v. 2, Oct. 1926, p. 289-290.

27. The pedagogic value of the history of physics.

School Review, v. 7, May 1899, p. 278-285.

Address delivered before the Colorado Science Teachers' Association 7 May 1898.

28. Carl Friedrich Gauss and his children (1).

Science, n.s., v. 9, 19 May 1899, p. 697-704.

29. Notes on the history of logarithms.

Zeitschr. f. Mathem. u. Physik, v. 44, Supplement, 1899, p. 31-39; the Supplement is also *Abhandlung zur Gesch. d. Mathematik*, Heft 9.

30. *A History of Physics in its Elementary Branches including the Evolution of Physical Laboratories.*

New York, 1899, 8+322 p.

Reprinted July 1906.

Revised and enlarged edition, New York, 1929, 13+424 p.

30*a*. Italian translation: *Storia della Fisica Elementare con l'Evoluzione dei Laboratori Fisici.* Tradotta in Italiano dal... D... GAMBIOLI con tre appendici sull: *Accademia del Cimento, sui fisici matematici e sui fisici italiani dei tempi recenti.* Riveduta dal ANGELO BATTELLI, Bologna, Zanichelli, 1909, 8+480.

New edition: *con 5 appendici sull'Accademia del Cimento, sui fisici matematici, sui fisici Italiani dei tempi recenti, sulle radiocommunicazioni, sul congresso di Como* (1927). Naples, Sandron, 1929. 588 p. (L'indagine moderna series).

(1) Compare *Carl Friedrich Gauss und die Seinen, Festschrift zu seinem 150. Geburtstage*, hrsg.v. H. MACK, Braunschweig, 1927, 12+150 p. + 11 plates. See also no. 89.

31. [Review of GERLAND and TRAUMÜLLER's *Geschichte der physik. Experimentierkunst.*]
Physical Review, v. 10, Feb. 1900, p. 127-128.

32. [Review of MAUPIN's *Opinions et Curiosités touchant la Mathématique* and LAISANT's *La Mathématique.*]
Amer. Math. So., *Bull.*, v. 6, Mar. 1900, p. 255-258.

33. The number concept.
Colorado College Studies, v. 8, Apr. 1900, p. 32-40.

34. [Review of BOYER's *Histoire des Mathématiques.*]
Science. n.s., v. 11, 15 June 1900, p. 947-948.

35. [Reviews of BRAUNMÜHL's *Vorlesungen über Geschichte der Trigonometrie*, Teil 1, and BOYER's *Histoire des Mathématiques.*]
Amer. Math. So., *Bull.*, v. 6, June 1900, p. 404-406.

36. Divergent and conditionally convergent series whose product is absolutely convergent.
Amer. Math. So., *Transactions*, v. 2, Jan. 1901, p. 25-36.

37. The unexplained southerly deviation of falling bodies.
Science, n.s., v. 14, 29 Nov. 1901, p. 853-855.
Compare no. 42.

38. The application of the fundamental laws of algebra to the multiplication of infinite series.
Amer. Math. So., *Bull.*, v. 8, Mar. 1902, p. 231-236.

39. [Review of NETTO's *Lehrbuch der Combinatorik.*]
Science, n.s., v. 16, 9 Sept. 1902, p. 469-470.

40. Series whose product is absolutely convergent.
Amer. Math. So., *Bull.*, v. 9, Jan. 1903, p. 188-194.

41. On the Chinese origin of the symbol for zero.
Amer. Math. Mo., v. 10, Feb. 1903, p. 35.

42. Southerly deviation of falling bodies.
Science, n.s., v. 17, 27 Mar. 1903, p. 508-509.
Compare no. 37.

43. [Review of BRAUNMÜHL's *Vorlesungen über Geschichte der Trigonometrie*, Teil 2.]
Amer. Math. So., *Bull.*, v. 10, Dec. 1903, p. 153-157.

44. [Review of MAUPIN's *Opinions et Curiosités*, série 2.]
Amer. Math. So., *Bull.*, v. 10, Jan. 1904, p. 206-207.

45. *An Introduction to the Modern Theory of Equations.*
New York, 1904, 10+239 p.

46. « Equations, general theory of », article in *Encyclopaedia Americana*, New York, v. 6, [1905], about 4½ unnumbered pages.
Also 1918, 1920, 1922, 1924, 1928 editions; in the last named (v. 10), p. 451-455.

47. Review of J. W. A. YOUNG and L. L. JACKSON's *Arithmetics*.
Colorado School Journal, v. 20, June 1905, p. 239.
48. Some hints on teaching mathematics to engineering students.
Society for the Promotion of Engineering Education, *Proceedings*, v. 13, 1906, p. 26-33.
49. [Review of *Leibnizens nachgelassene Schriften* (ed. GERLAND).]
Amer. Math. So., *Bull.*, v. 13, Feb. 1907, p. 252.
50. [Review of PESLOÜAN's *N. H. Abel, sa Vie et son Œuvre*.]
Amer. Math. So., *Bull.*, v. 13, Mar. 1907, p. 305-306.
51. [Review of J. TANNERY's *Leçons d'Algèbre et d'Analyse*, v. 1]
Amer. Math. So., *Bull.*, v. 14, Oct. 1907, p. 21-24.
52. [Review of PESLOÜAN's *N. H. Abel, Sa Vie et son Œuvre*.]
Science, n.s., v. 26, 8 Nov. 1907, p. 636.
53. On the transformation of algebraic equations by ERLAND SAMUEL BRING (1786), translated [from the Latin] and edited by F. CAJORI.
Colorado College Publications, general series, no. 31, Nov. 1907, p. 65-91.
54. Organized reform.
Colorado School Jl., v. 23, Jan. 1908, p. 103-104.
55. Lessons drawn from the history of science.
School Science and Math., v. 8, Feb. 1908, p. 85-96.
56. Notes on the history of the slide rule.
Amer. Math. Mo., v. 15, Jan. 1908, p. 1-4.
57. Discussion of the report of the committee on algebra.
School Science and Math., v. 8, Mar. 1908, p. 205-208.
58. [Review of S. P. THOMPSON's Petrus Peregrinus de Maricourt.]
Amer. Math. So., *Bull.*, v. 14, Mar. 1908, p. 295-296.
59. [Review of BOPP's Kegelschnitte des Gregorius a St. Vincentio.]
Amer. Math. So., *Bull.*, v. 14, Apr. 1908, p. 337-338.
60. [Review of MATHEW's *Algebraic Equations*.]
Amer. Math. So., *Bull.*, v. 14, June 1908, p. 448-450.
61. [Review of HERING's *Das 200-jährige Jubiläum der Dampfmaschine, 1706-1906*.]
Amer. Math. So., *Bull.*, v. 14, June 1908, p. 453-454.
62. The history of the conservation of energy; the age of the earth and the sun.
Popular Science Mo., v. 73, Aug. 1908, p. 97-111.
Reprinted in *Scient. Amer. Suppl.* v. 66, 1908 : « The law of conservation of energy. How Mayer discovered it », 22 Aug. 1908, p. 103; « The age of the sun and the earth. Some ancient and modern theories » 12 Sept., 1908, p. 174-175.

63. « Arithmetik. Algebra. Zahlentheorie ».
M. CANTOR, ed., *Vorlesungen über Geschichte der Mathematik*, Leipzig, v. 4, 1908, p. 37-198.

64. Aaron Palmer's computing scale.
Colorado College Publications, general series, no. 42, June 1909, p. 111-119.

65. John E. Fuller's circular slide rules.
Colorado College Publications, general series, no. 42, June 1909, p. 120-122.

66. Slide rules with « runners ».
Archiv für die Gesch. d. Naturwiss. u. der Technik, v. 1, 1909, p. 370-375.

67. Introductory note [to G. VACCA's « Maurolycus, the first discoverer of the principle of mathematical induction ».]
Amer. Math. So., *Bull.*, v. 16, Nov. 1909, p. 70.

68. [Review of BOREL's *Elemente der Mathématik*.]
Amer. Math. So., *Bull.*, v. 16, Nov. 1909, p. 89-90.

69. *A History of the Logarithmic Slide Rule and Allied Instruments*. New York, 1909, 8+126+10 p.+5 plates.

70. « Fractions »; « Limits, theory of »; « Theory of equations, general »; « trisection of an angle » in *United Editors Encyclopedia and Dictionary*.
New York, 1909.

71. [Review of A. W. STAMPER's *History of the Teaching of Elementary Geometry*.]
Science, n.s., v. 30, 17 Dec. 1909, p. 887-888.

72. On the invention of the slide rule.
Nature, v. 82, 30 Dec. 1909, p. 267-268.
Abstract of a paper read before the Section of Mathem. and Phys. Science, British Assoc. Adv. of Sci., Winnipeg, 27 Aug. 1909.

73. Graphic railroad time tables.
School Science and Math., v. 10, 24 Feb. 1910, p. 204-205.

74. On the invention of the slide rule.
Colorado College Publications, general series, no. 47, Feb. 1910, p. 176-185.

75. A note on the history of the slide rule.
Bibliotheca Mathematica, s. 3, v. 10, May 1910, p. 161-163.

76. Note 275 in « Tribune publique 13 ».
Encyclopédie des Sciences Mathém., tome 1, v. 3, fasc. 3, June 1910, p. 50.

77. [Review of D. E. SMITH's *Rara Arithmetica*.]

Science, n. s, v. 32, 22 July 1910, p. 114-115.

78. Note 239 in « Tribune publique 12 ».
Encyclopédie des Sciences Mathém., tome 1, v. 2, fasc. 2, Aug. 1910, p. 45.

79. Attempts made during the eighteenth and nineteenth centuries to reform the teaching of geometry.
Amer. Math. Mo., v. 17, Oct. 1910, p. 181-201.

80. A history of the arithmetical methods of approximation to the roots of numerical equations of one unknown quantity.
Colorado College Publications, general series nos. 51-52, Oct.-Nov. 1910 : also science series, v. 12, p. 171-287.

81. Historical note on the Newton-Raphson method of approximation.
Amer. Math. Mo., v. 18, Feb. 1911, p. 29-32.

82. Fourier's improvement of the Newton-Raphson method of approximation anticipated by Mourraille.
Bibliotheca Mathematica, s. 3, v. 11, Apr. 1911, p. 132-137.

83. Horner's method of approximation anticipated by Ruffini.
Amer. Math. So., *Bull.*, v. 17, May 1911, p. 409-414.

83*a*. Italian translation by G. Loria : P. Ruffini ed il così detto « Metodo di Horner ».
Bollettino di Bibl. e Storia d. Sc. Matematiche, v. 13, July-Dec. 1911, p. 81-86.

84. On Michel Rolle's book « Methode pour résoudre les égalitez » and the history of « Rolle's Theorem ».
Bibliotheca Mathematica, s. 3, v. 11, Nov. 1911, p. 300-313.

85. *Notes on the History of Geometry and Algebra*.
Boston, [1911], 25 p.

86. [Review of Smith and Karpinski's *The Hindu-Arabic Numerals*.]
Science, n.s., v. 35, 29 Mar. 1912, p. 501-504.

87. A review of three famous attacks upon the study of mathematics as a training of the mind.
Popular Science Mo., v. 80, Apr. 1912, p. 360-372.

88. On the Spanish symbol *U* for « thousands ».
Bibliotheca Mathematica, s. 3, v. 12, May 1912, p. 133-134.

89. Notes on Gauss and his American descendants.
Pop. Sci. Mo., v. 81, Aug. 1912, p. 105-114. Illustr.
Compare no. 28.

90. Historical note on the graphic representation of imaginaries before the time of Wessel.
Amer. Math. Mo., v. 19, Sept.-Oct. 1912, p. 167-171.

91. The evolution of the dollar-mark.
Pop. Sci. Mo., v. 81, Dec. 1912, p. 521-530.

92. History of the exponential and logarithmic concepts.
Amer. Math. Mo., v. 20, Jan.-May 1913, p. 5-14, 35-47, 75-84, 107-117, 148-151, 173-182, 205-210.
Corrections are given in a footnote of no. 116.

93. [Review of G. B. HALSTED's *On the Foundation and Technic of Arithmetic*.]
Science, n.s., v. 37, 18 Apr. 1913, p. 609-610.

94. Plus and minus again.
Science, n.s., v. 38, 11 July 1913, p. 51-52.

95. [Review of H. G. ZEUTHEN's *Die Mathematik im Altertum und im Mittelalter*.]
Astrophysical Jl., v. 38, Sept. 1913, p. 207.

96. More data on the history of the dollar mark.
Science, n.s., v. 38, 12 Dec. 1913, p. 848-850.

97. Science and mathematics in vocational schools: a retrospect.
School Science and Math., v. 14, Feb. 1914, p. 97-107.

98. A new marking system and means of measuring mathematical abilities.
Science, n.s., v. 39, 12 June 1914, p. 874-881.
Read at Des Moines, Ia., before the mathematics section of the Central Assoc. of Science and Mathematics.

99. The Napier tercentenary celebration.
Amer. Math. Mo., v. 21, Dec. 1914, p. 321-323.

100. The cross $\times$ as a symbol of multiplication.
Nature, v. 94, 2 Dec. 1914, p. 363-364.

101. The colon as a symbol for ratio and division.
Nature, v. 94, 31 Dec. 1914, p. 477.

102. *School Arithmetics, Primary Book.*
New York, 1914, 10+285 p.

103. The history of Zeno's arguments on motion.
Amer. Math. Mo., v. 22, Jan.-Nov. 1915, p. 1-6, 39-47, 77-82, 109-115, 143-149, 179-186, 215-220, 253-258, 292-297.

104. On the history of a notation in trigonometry.
Nature, v. 94, 11 Jan. 1915, p. 642-643.

105. On an integration ante-dating the integral calculus.
Bibliotheca Mathematica, v. 14, Mar. 1915, p. 312-319.

106. Origin of a mathematical symbol for variation.
Nature, v. 95, 22 July 1915, p. 562.

107. The works of William Oughtred.
The Monist, v. 25, July, 1915, p. 441-466.

108. The Life of William Oughtred.
Open Court, v. 29, Aug. 1915, p. 449-459.

109. Oughtred's ideas and influence on the teaching of mathematics.
The Monist, v. 25, Oct. 1915, p. 495-530.

110. Notes on the early history of the slide rule.
Colorado College Publications, general series no. 84, Dec. 1915, p. 234-237.

111. Algebra in Napier's day and alleged prior inventions of logarithms.
Napier Tercentenary Memorial Volume, ed. by C. G. KNOTT, London, 1915, p. 93-109.

112. *Elementary Algebra. First Year Course.*
New York, 1915. 7+206 p.
By F. CAJORI and LETITIA R. ODELL.

113. *School Arithmetics, Intermediate.*
New York, 1915. 299 p.

114. *School Arithmetics. Grammar School Book.*
New York, 1915. 9+437 p.

115. Anomalous forms in writing numbers.
School Science and Math., v. 16, Mar. 1916, p. 246-247.

116. Napier's logarithmic concept : a reply.
Amer. Math. Mo., v. 23, Mar. 1916, p. 71-72.
A reply to H. S. CARSLAW's article in *Math. Gazette*, May, 1915, p. 78. This « reply » brought forth a rejoinder by CARSLAW in *Amer. Math. Mo.*, Oct. 1916, p. 310-312; then follows « Comment » by CAJORI, p. 312-313.

117. [Review of L. C. KARPINSKI's *Robert of Chester's Latin translation of the Algebra of al-Khowarizmi.*]
Amer. Math. Mo., v. 23, Apr. 1916, p. 116-117.

118. [Review of G. A. MILLER's *Historical Introduction to Mathematical Literature.*]
Science, n.s., v. 43, 19 May 1916, p. 713-714.

119. Leibniz's « Image of Creation ».
The Monist, v. 26, Oct. 1916, p. 557-565.

120. The zero and the principle of local value used by the Maya of Central America.
Science, n.s., v. 44, 17 Nov. 1916, p. 714-717.

121. [Review of *L'Opera « De Corporibus Regularibus » di Petro Franceschi.*]
Amer. Math. Mo., v. 23, Dec. 1916, p. 384.

122. *Elementary Algebra. Second Year Course.*
New York, 1916, 201 p.
By F. CAJORI and LETITIA R. ODELL.

123. *William Oughtred. A great Seventeenth-Century Teacher of Mathematics.*
Chicago, 1916. 6+100 p.

124. Unified mathematics.
Colorado School Jl., v. 32, Jan. 1917, p. 17-20.

125. [Review of MACFARLANE's *Lectures on Ten British Mathematicians.*]
Science, n.s., v. 45, Jan. 1917, p. 88-89.

126. Discussion of fluxions : from Berkeley to Woodhouse.
Amer. Math. Mo., v. 24, Apr. 1917, p. 145-154.

127. Newton's solution of numerical equations by means of slide rules.
Colorado College Publications, general series, no. 95, Nov. 1917, p. 245-253.

128. Pierre Laurent Wantzel.
Amer. Math. So., *Bull.*, v. 24, Apr. 1918, p. 339-347.

129. Origin of the name ' mathematical induction '.
Amer. Math. Mo., v. 25, May 1918, p. 197-201.

130. Plans for a history of mathematics in the nineteenth century.
Science, n.s., v. 48, 20 Sept. 1918, p. 179-284.
Address as retiring president of the Mathematical Association of America, 7 Sept. 1918.

131. What is the origin of the name ' Rolle's curve '?
Amer. Math. Mo., v. 25, Sept. 1918, p. 291-292.

132. On the history of « Playfair's parallel postulate ».
School Science and Math., v. 18, Dec. 1918, p. 778-779.

133. A Greek tract on indivisible lines.
Science, n.s., v. 48, 6 Dec. 1918, p. 577-578.

134. Who was the first inventor of the calculus?
Amer. Math. Mo., v. 26, Jan. 1919, p. 15-20.
Review of J. M. CHILD's *The Geometrical Lectures of Isaac Barrow.*

135. Observations on the development of algebraic notations [abstract].
Amer. Math. So., *Bull.*, v. 25, June 1919, p. 394.

136. How x came to stand for unknown quantity.
School Science and Math., v. 19, Nov. 1919, p. 698-699.

137. The controversy on the origin of our numerals.
The Scientific Mo., v. 9, Nov. 1919, p.458-464.

138. *A History of the Conceptions of Limits and Fluxions in Great Britain from Newton to Woodhouse.*
Chicago, 1919. 8+299 p. 1 portrait.

139. The purpose of Zeno's arguments on motion.
Isis, v. 3, Jan. 1920, p. 7-20.

140. On the history of Gunter's scale and the slide rule during the seventeenth century.
Univ. of California, *Publications in Mathematics*, v. 1, no. 9, 17 Feb. 1920, p. 187-209.

141. A list of Oughtred's mathematical symbols, with historical notes.
Univ. of California, *Publications in Mathematics*, v. 1, no. 8, 18 Feb. 1920, p. 171-186.

142. [Review of RUGG and CLARK's *Fundamentals of High School Mathematics*.]
Sierra Educational News, San Francisco, v. 16, Apr. 1920, p. 229.

143. [Review of AUERBACH and WALSH's *Plane Geometry*.]
Sierra Educational News ,v. 16, May 1920, p. 293.

144. Aristotle and Galileo on falling bodies.
Science, n.s., v. 51, 18 June 1920, p. 615-616.

145. Talk on logarithms and slide rules.
School Science and Math., v. 20, June 1920, p. 527-530.
Talk before the undergraduate Math. Club Univ. of Cal. 10 Mar. 1920.

146. Moritz Cantor, the historian of mathematics.
Amer. Math. So., *Bull.*, v. 27, Oct. 1920, p. 21-28.

147. Galileo's experiments from the Tower of Pisa.
Science, n.s., v. 52, 29 Oct. 1920, p. 409.

148. Augustus De Morgan on divergent series.
Amer. Math. So., *Bull.*, v. 27, Nov. 1920, p. 77-81.

149. [Review of CHILD's *The Early Mathematical Manuscripts of Leibniz*.]
Amer. Math. Mo., v. 27, Dec. 1920, p. 469-470.

150. Greek philosophers on the disciplinary value of mathematics.
Mathematics Teacher, v. 13, Dec. 1920, p. 57-62.

151. Minimum high school mathematics.
School Science and Math., v. 21, Jan. 1921, p. 25-28.

152. Reply to Professor Horn.
Science, n.s., v. 53, 11 Feb. 1921, p. 139.
Reply to D. W. HORN's criticism (*Science*, 14 Jan. 1921) of no. 147.

153. History of science and the American Association for the Advancement of Science.
Science, n.s., v. 53, 18 Feb. 1921, p. 163-164.

154. Euclid of Alexandria and the rise of Euclid of Megara.
Science, n.s., v. 53, 29 Apr. 1921, p. 414-415

155. Note on the Fahrenheit scale.
Physical Review, s. 2, v. 17, Apr. 1921, p. 156.
Compare no. 160.

156. The spread of the Newtonian and Leibnizian notations of the calculus.
Amer. Math. So., *Bull.*, s. 2, v. 27, June-July 1921, p. 453-458.

157. Histroy of Symbols for n-factorial.

Isis, v. 3, « summer » 1921, p. 414-418.

158. Swiss geodesy and the United States Coast Survey.
Scientific Mo., v. 13, Aug. 1921, p. 117-129.

159. Falling bodies in ancient and modern times.
School Science and Math., v. 21, Oct. 1921, p. 638-648.

160. Note on the Fahrenheit scale.
Isis, v. 4, 1921, p. 17-22.

161. Sexagesimal fractions among the Babylonians.
Amer. Math. Mo., v. 29, Jan. 1922, p. 8-10.

162. [Review of CLAIRAUT's *Éléments de Géométrie*.]
Amer. Math. So., *Bull.*, v. 28, Mar. 1922, p. 133.

163. A curious mathematical title-page.
Scientific Mo., v. 14, Mar. 1922, p. 294-296.

164. Newton's discovery of gravitation.
University of California Chronicle, v. 24, Apr. 1922, p. 232-238.

165. Pricked letters and ultimate ratios.
Nature, v. 109, 15 Apr. 1922, p. 477.

166. Heinrich Suter.
Science, n.s., v. 55, 28 Apr. 1922, p. 447.

167. A letter of John Kepler.
Popular Astronomy, v. 30, Apr. 1922, p. 217-219.

168. Tangent lines among the Greeks.
School Science and Math., v. 22, May 1922, p. 463-464.

169. Robert Recorde.
Mathematics Teacher, v. 15, May 1922, p. 294-302.

170. Spanish and Portuguese symbols for ' thousands '.
Amer. Math. Mo., v. 29, May 1922, p. 201-202.

171. [Review of CARNOT's *Réflexion sur la Métaphysique*.]
Amer. Math. So., *Bull.*, v. 28, June 1922, p. 273.

172. Can waste of mental effort be avoided?
Science, n.s., v. 56, 29 Sept. 1922, p. 355-356.

173. The formula $\frac{1}{2}\, a\,(a + 1)$ for the area of an equilateral triangle.
Amer. Math. Mo., v. 29, Sept. 1922, p. 303-304, 306-307.

174. George Bruce Halsted.
Amer. Math. Mo., v. 29, Oct. 1922, p. 338-340.

175. The St. Andrew's cross ($\times$) as a mathematical symbol.
Mathematical Gazette, v. 11, Oct. 1922, p. 136-143.

176. Origin of the names arithmetical and geometrical progression and proportion.
School Science and Math., v. 22, Nov. 1922, p. 734-737.

177. [Review of LAPLACE's *Essai... sur les Probabilités*; LAVOISIER and

LAPLACE's *Mémoire sur la chaleur*; AMPÈRE's *Mémoires sur l'électrodynamique*.]

Amer. Math. So., *Bull.*, v. 28, Nov. 1922, p. 417.

178. Newton and the law of gravitation.
Archivio di Storia della Scienza, v. 3, 9 Dec. 1922, p. 201-204.

179. Tangent lines.
Science, n.s., v. 56, 15 Dec. 1922, p. 687.

180. On the history of caloric.
Isis, v. 4, 1922, p. 483-492.

181. On the prevalence of inaccurate criticism.
Isis, v. 4, 1922, p. 494-496.

182. Tangent lines again.
School Science and Math., v. 23, Jan. 1923, p. 64-66.

183. The mathematical sciences in the Latin colonies of America.
Scientific Mo., v. 16, Feb. 1923, p. 194-204.

184. The origin of the symbols for « degrees, minutes and seconds ».
Amer. Math. Mo., v. 30, Feb. 1923, p. 65-66.

185. The name « divergent » series.
Amer. Math. So., *Bull.*, v. 29, Feb. 1923, p. 55.

186. Professor A. N. Favaro.
Nature, v. 111, 17 Mar. 1923, p. 368.

187. Recent symbolisms for decimal fractions.
Mathematics Teacher, v. 16, Mar, 1923, p. 183-187.

188. Varieties of minus signs.
Mathematics Teacher, v. 16, May 1923, p. 295-301.

189. [Review of ANDOYER's *L'Œuvre scientifique de Laplace*.]
Amer. Math. So., *Bull.*, v. 29, May 1923, p. 232.

190. The evolution of our exponential notation.
School Science and Math., v. 23, June 1923, p. 573-581.

191. Grafting the theory of limits on the calculus of Leibniz.
Amer. Math. Mo., v. 30, July-Aug. 1923, p. 223-234.

192. The history of notations of the calculus.
Annals of Math., n.s., v. 25, Sept. 1923, p. 1-46.

193. Review of JAMBLICUS's *Theologovmena Arithmeticae*.
Amer. Math. So., *Bull.*, v. 29, Oct. 1923, p. 377.

194. Symbols for « therefore », and « greater » or « less than ».
Mathematical Gazette, v. 11, Oct. 1923, p. 383-384.

195. Did Pitiscus use the decimal point?
Archivio di Storia della Scienza, v. 4, Dec. 1923, p. 313-318.

196. Mathematical signs of equality.
Isis, v. 5, 1923, p. 116-125.

197. Gustaf Eneström.

Science, n.s., v. 59, Jan. 1924, p. 10.

198. A castigation and an appeal.
Science, n.s., v. 59, 22 Feb. 1924, p. 191.

199. A correction of a correction.
School and Society, v. 19, 23 Feb. 1924, p. 225.

200. The unification of mathematical notations in the light of history.
Mathematics Teacher, v. 17, Feb. 1924, p. 87-93.
Vice-presidential address before Section L of the American Association for the Advancement of Science 29 Dec. 1923.

201. Rahn's algebraic symbols.
Amer. Math. Mo., v. 31, Feb. 1924, p. 65-71.

202. [Review of E. BORTOLOTTI's *Lezioni di Geometria Analitica*.]
Amer. Math. Mo., v. 31, Feb. 1924, p. 98-99.

203. The growth of the legend about Sir Isaac Newton.
Science, n.s., v. 59, 2 May 1924, p. 390-392.
Reprinted in *Popular Astronomy*, v. 32, Oct. 1924, p. 482-286.
Reprinted in Royal Astron. So. Canada, *Jl.*, v. 18, Nov. 1924, p. 386-391.

204. [Review of L. THORNDYKE's *History of Magic*.]
Amer. Math. Mo., v. 31, May 1924, p. 244-246.

205. Notes on Luca Pacioli's 'Summa'.
Archivio di Storia della Scienza, v. 5, June 1924, p. 125-130.

206. The school of education and the university.
School and Society, v. 20, 26 July 1924, p. 108-109.

207. Despiau's *Select Amusements*.
Mathematical Gazette, v. 12, Oct. 1924, p. 216.

208. Empiric generalizations on the growth of mathematical notations.
Isis, v. 6, 1924, p. 391-394.

209. The Baconian method of scientific research.
Scientific Mo., v. 20, Jan. 1925, p. 85-91.

210. Number of United States scientists when the Sigma Xi Society was founded.
Science, n.s., v. 61, 30 Jan. 1925, p. 117-118.

211. Fanciful hypotheses on the original of the numeral forms.
Mathematics Teacher, v. 18, Mar. 1925, p. 129-133.

212. The death of Archimedes.
Science, n.s., v. 61, 17 Apr. 1925, p. 415.

213. Early printed forms of our dollar mark.
School and Society, v. 21, 23 May 1925, p. 625-626 (illustr.).

214. Indivisibles and «ghosts of departed quantities» in the history of mathematics.
Scientia, v. 37, May 1925, p. 301-306.

French translation by E. PHILIPPI, p. 93-98.

215. [Review of *La Thiende de Simon Stevin* par H. BOSMANS.]
Science, n.s., v. 61, 5 June, 1925, p. 591.

216. American contributions to mathematical symbolism.
Amer. Math. Mo., v. 32, Oct. 1925, p. 414-416.

217. A suggested list of mathematical books for junior college libraries.
Amer. Math. Mo., v. 32, Nov. 1925, p. 462-468.
This list was prepared by a Committee of five of which F. CAJORI was a member.

218. [Review of J. W. N. SULLIVAN's *History of Mathematics in Europe*.]
Amer. Math. Mo., v. 32, Dec. 1925, p. 512-513.

219. Leibniz the master-builder of mathematical notations.
Isis, v. 7, 1925, p. 412-429.

220. Sir Isaac Newton's early study of the Apocalypse.
Popular Astronomy, v. 34, Feb. 1926, p. 75-78.

221. [Review of WIELEITNER's *Der Gegenstand der Mathematik*.]
Amer. Math. Mo., v. 33, Mar. 1926, p. 151-152.

222. Early « proofs » of the impossibility of a fourth dimension of space.
Archivio di Storia della Scienza, v. 7, Mar.-June 1926, p. 25-28.

223. Did Davy melt ice by friction in a vacuum?
Nature, v. 117, 10 Apr. 1926, p. 519.

224. Mathematics in modern liberal education.
Univ. of California Chronicle, v. 28, July 1926, p. 294-309.

225. Ce que Newton doit à Descartes.
L'Enseignement Mathématique, v. 25, Sept. 1926, p. 7-11.
Translated into French by J. P. DUMUR.

226. [Review of A. REYMOND's *Histoire des Sciences*.]
Amer. Math. So., *Bull.*, v. 32, Sept.-Oct. 1926, p. 556-557,

227. Are the heavens full or are they void?
Scientific Mo., v. 23, Oct. 1926, p. 346-355.

228. Origins of fourth dimension concepts.
Amer. Math. Mo., v. 33, Oct. 1926, p. 397-406.

229. Madame du Châtelet on fluxions.
Mathematical Gazette, v. 13, Dec. 1926, p. 252.

230. [Review of the SMITH-LATHAM edition of the Geometry of RENÉ DESCARTES.]
Amer. Math. Mo., v. 33, Dec. 1926, p. 517-518.

231. [Review of P. BRUNET's *Les physiciens hollandais et la méthode expérimentale en France au XVIIIe siècle*.]
Physical Review, v. 29, Jan. 1927, p. 197.

232. Babylonian discovery of the precession of the equinoxes.
Science, n.s., v. 65, 18 Feb. 1927, p. 184.

233. [Review of HOPPE's *Geschichte der Physik* (in GEIGER and SCHEEL's *Handbuch der Physik*.)]
Physical Review, v. 29, Feb. 1927, p. 346.

234. Frederick the Great on mathematics and mathematicians.
Amer. Math. Mo., v. 34, Mar. 1927, p. 122-130.

235. [Review of NEUGEBAUER's *Die Grundlagen der ägyptischen Bruchrechnung*.]
Amer. Math. So., *Bull.*, v. 33, May-June, 1927, p. 271.

236. [Review of D'OOGE-ROBBINS-KARPINSKI's *Nicomachus of Gerasa*.]
Amer. Math. Mo., v. 34, May 1927, p. 269.

237. The logarithms of Napier.
Science, n.s., v. 65, 3 June 1927, p. 547.

238. [Review of REYMOND's *History of Science in Greco-Roman antiquity*.]
Physical Review, v. 30, Aug. 1927, p. 224.

239. [Review of SARTON's *Introduction to the History of Science*, v. 1.]
Science, n.s., v. 66, 16 Sept. 1927, p. 260-262.

240. [Review of *Œuvres Complètes* de CHR. HUYGENS, tome 15.]
Amer. Math. So., *Bull.*, v. 33, Sept.-Oct. 1927, p. 627.

241. The earliest arithmetic published in America.
Isis, v. 9, Dec. 1927, p. 391-401+1 plate.

242. Briefe von C. H. Schumacher und W. Struve an F. R. Hassler in Amerika.
Zeitschrift für Instrumentenkunde, v. 47, Nov. 1927, p. 532-536.

243. The date of Burton's birth as calculated from his nativity.
In R. Burton, *The Anatomy of Melancholy*, ed. by F. Dell and P. J. Smith, New York, v. 2, 1927, p. 978-980.

244. Burton's horoscope and the date of his birth.
Popular Astronomy, v. 36, Jan. 1928, p. 9-10+1 plate.

245. Comparison of methods of determining calendar dates by finger reckoning.
Archeion, Archivio di Storia d. Sc., v. 9, Jan.-Mar. 1928, p. 31-42.

246. Four old astronomical observatory buildings.
Scientific Mo., v. 26, Apr. 1928, p. 372-376.

247. Henry Bosmans.
Science, n.s., v. 67, 6 Apr. 1928, p. 362-363.

248. Isaac Newton's experiments on light.
School Science and Math., v. 28, June 1928, p. 618-626.

249. Sir Isaac Newton on gravitation.
Scientific Mo., v. 27, July 1928, p. 47-53.

250. Ciruelo on the names « arithmetical » and « geometrical » proportions and progressions.

Isis, v. 10, June 1928, p. 363-366.

251. [Review of PTOLEMÉE, *Composition Mathématique* par M. HALMA.]
Amer. Math. So., *Bull.*, v. 34, July-Aug. 1928, p. 527-528.

252. The early history of partial differential equations and of partial differentiation and integration.
Amer. Math. Mo., v. 35, Nov. 1928, p. 459-467.

252*a*. Spanish translation by A. KURLAT: Historia del origen de las ecuaciones diferenciales en derivadas parciales y de la diferenciacion e integracion parcial, *Revista Matem. Hispano-Americana*, s. 2., v. 4, Apr.-May 1929, p. 81-95.

253. The sieve of Eratosthenes.
Science, v. 68, 21 Dec. 1928, p. 620.

254. A revaluation of Harriot's *Artis Analyticae praxis*.
Isis, v. 11, Dec. 1928, p. 316-324.

255. *The Early Mathematical Sciences in North and South America.*
Boston, 1928, 156 p.+15 plates.

256. *Mathematics in Liberal Education. A critical examination of the Judgments of Prominent Men of the Ages.*
Boston, 1928, 178 p.

257. Newton's twenty years' delay in announcing the law of gravitation.
In *Sir Isaac Newton* 1727-1927, *a Bicentenary Evaluation of His Work*, Baltimore, 1928, p. 127-188.

258. Newton's fluxions.
In *Sir Isaac Newton* 1727-1927, *a Bicentenary Evaluation of His Work*, Baltimore, 1928, p. 191-200.

259. Uniformity of mathematical notations — retrospect and prospect.
Intern. Math. Congress, Proc., Toronto, v. 2, 1928, p. 929-936.

260. Past struggles between symbolists and rhetoricians in mathematical publications.
Intern. Math. Congress, Proc., Toronto, v. 2, 1928, p. 937-941.

261. *A History of Mathematical Notations.*
Chicago, v. 1, *Notations in Elementary Mathematics*, 1928. 16+451 p. v. 2, *Notations Mainly in Higher Mathematics*, 1929. 18+367 p.

262. Christiaan Huygens.
Scientific Mo., v. 28, Mar. 1929, p. 220-225.

263. Controversies on mathematics between Wallis, Hobbes, and Barrow.
Mathematics Teacher, v. 22, Mar. 1929, p. 146-151.

264. [Review of *Drei Abhandlungen über die Auflösung der Gleichungen von* L. EULER (1738, 1764, 1790).]
Amer. Math. So., *Bull.*, v. 35, May-June 1929, p. 411.

265. [Review of K. FLADT's *Quellenhefte zur Elementarmathem.*, Band I.]

Amer. Math. So., *Bull.*, v. 35, May-June 1929, p. 412.

266. [Review of ENRIQUES, *L'Évolution des Idées Géométriques dans la Pensée Grecque*.]
Amer. Math. So., *Bull.*, v. 35, May-June 1929, p. 415-416.

267. Sir Isaac Newton's edition of Varen's geography.
Mathematical Gazette, v. 14, Apr. 1929, p. 415-416.

268. The origin of the dollar mark.
The Numismatist, v. 42, Aug. 1929, p. 489-493.

269. [Review of KEPLER'S *Neue Astronomie*.]
Science, v. 70, 9 Aug. 1929, p. 144-145.

270. A forerunner of Mascheroni.
Amer. Math. Mo., v. 36, Aug. -Sept. 1929, p. 364-365.

271. [Review of LORIA'S *Storia delle Matematiche*, vol. I.]
Amer. Math. Mo., v. 36, Aug.-Sept. 1929, p. 387-388.

271*a*. Italian translation by G. LORIA : *Il Bollettino di Matematica*, v. 26, 1930, p. XII-XIV.

272. New data on the origin and spread of the dollar mark.
Scientific Mo., v. 29, Sept. 1929, p. 212-216.

273. The translator of Newton's « System of the World ».
Nature, v. 124, 5 Oct. 1929, p. 513.

274. Generalizations in geometry as seen in the history of developable surfaces.
Amer. Math. Mo., v. 36, Oct. 1929, p. 431-437.

275. History of determinations of the heights of mountains.
Isis, v. 12, Dec. 1929, p. 482-514.

276. « Binomial formula », « History of Geometry », « Logarithms », [articles in :]
Encyclopædia Britannica, 14th ed. New York, 1929, v. 3, p. 588-589; v. 10, p. 178-180; v. 14, p. 301-305.

277. « Euler on the use of *e* to represent 2.718... », « Delamain on the slide rule », « Oughtred on the slide rule », « Rolle on the location of roots », « Berkeley's Analyst », « Euler on differential equations of the second order » [articles in :]
A Source Book in Mathematics, New York, 1929, p. 95-98, 156-159, 160-164, 253-260, 627-634.

278. *The Chequered Career of Ferdinand Rudolph Hassler, First Superintendent of the United States Coast Survey.*
Boston, 1929. 245 p.

279. [Review of *Quellen u. Studien z. Gesch. d. Mathem.*, v. 1, pt. 1.]
Amer. Math. So., *Bull.*, v. 26, Jan. 1930, p. 36-37.

280. Newton's idea of God as found in the different editions of his *Principia*.

Open Court, v. 44, Feb. 1930, p. 65-72.

281. [Review of CHACE's edition of the *Rhind Mathematical Papyrus*.]
Amer. Math. Mo., v. 37, Apr. 1930, p. 189-191.

282. Johannes Kepler, 1571-1630.
Scientific Mo., v. 30, May 1930, p. 385-393.

283. Unification of mathematical notation.
Scientia, v. 48, Sept. 1930, p. 145-147.

284. The word « logarithm » used before the time of Napier.
Archeion, Archivio di Storia della Scienza, v. 12, July-Dec. 1930, p. 229-233.

285. [An English edition of NEWTON's *Principia*, with Notes.]
Berkeley, Univ. of Cal. Press, 1932.

286. [An edition of NEWTON's *Opticks*, with Notes.]
Future publication improbable.

Brown University, *Providence, R. I.*

RAYMOND CLARE ARCHIBALD.

Helvetius, Spinoza, and Transmutation

The transmutation of lead into gold by HELVETIUS is regarded by believers in the occult as historically incontestable (1), which is not surprising considering the circumstantial details leading to and of the event as described by HELVETIUS (2), a man of high repute (3), a member of a highly respected and learned family (4) and originally a strong opponent of transmutation (5). Furthermore, it is generally asserted that SPINOZA had *convinced* himself of the correctness of HELVETIUS's claim. Thus WACKEN-

(1) See SCHLITTE, *Questionem politicam an Alchemistae sint in republica tolerandi?...*, p. 37, Halae Magdeburgicae (1702); ARVIDSON, *Dissertatio gradualis sistens chemiae progressus...*, p. 27, Upsaliae (1782); GULDENFALK, *Sammlung von mehr als hundert wahrhaften Transmutationsgeschichten...*, p. 204, Frankfurt and Leipzig (1784); (BARRATT), *The Lives of the Adepts...*, p. 78, London (1814); FIGUIER, *L'Alchimie et les Alchimistes...*, p. 211, Paris (1856); WAITE, *Lives of the Alchemical Philosophers...*, p. 201, London (1888); BRENDT, *Das Buch der Wunder*, ii, p. 709, S. A. (according to FERGUSON, *Bibliotheca Chemica...*, i, p. 385, Glasgow (1906), BRENDT's work appeared in 1901); REDGROVE, *Alchemy: Ancient and Modern...*, p. 83, London (1911), from which the following quotation (p. 89) is typical: "Testimony such as this warns us not to be too sure that a real transmutation has never taken place."; WAITE, *The Secret Tradition in Alchemy...*, p. 307, London (1926).

(2) The *Vitellus Aureus* by J. F. HELVETIUS appeared in a number of editions, dealt with bibliography by FERGUSON, *Bibliotheca Chemica...*, i, p. 383, Glasgow (1906). FERGUSON has however omitted the German translation of 1705 which is in the author's possession. This edition, without place of publication, is mentioned by ROTH-SCHOLTZ, *Deutsches Theatrum Chemicum...*, i, p. 484, Nürnberg (1728), where it is suggested that it was published in Leipzig.

(3) Compare KRUL, "Jean-Frederic Helvetius et sa Famille," *Janus*, i, 564 (1896-1897).

(4) See KRUL, *loc. cit.*; also POLLOCK, *Spinoza, his Life and Philosophy...*, p. 97, London (1886).

(5) HELVETIUS, *Theatridium Herculis Triumphantis...*, s'Gravenhage (1663), which is a severe attack on DIGBY in particular and the philosophers' stone in general. See THOMSON, *A History of Chemistry*, i, p. 18, London (1831).

RODER (6), after referring to the interest shown by LEIBNITZ in transmutation, writes as follows :

" Noch ein anderer berühmter Philosophe, Benedict Spinoza, schenkte den Künsten des Alchemisten Schweitzer, welcher sich gewöhnlich Helvetius nannte und Leibarzt des Prinzen von Oranien war eine besondere Aufmerksamkeit. Eben dadurch bestätigt sich, dass der Glaube an die Metallverwandlung keines wegs einer war, welchen bloss Schwärmer und Ungebildete hegten, sondern der sich auch vertrug mit den durchgebildetten Gelehrsamkeit in allen Ländern."

KOPP (7), in his general observations on transmutation, writes in reference to HELVETIUS :

" ... interessant ist namentlich der Antheil, welchen der berühmte Benedict Spinoza daran genommen hat. Dieser, der sonst nicht zu den Leichtgläubigen gehörte, erkundigte sich genau nach allen Umständen, und sprach brieflich seine Ueberzeugung aus, dass auch für ihn diese Transmutation vollkommend überzeugend sei."

Similar to those of KOPP are the following observations, by FIGUIER (8) :

" Spinoza, qui n'est pas rangé parmi les gens crédules, dit, dans une de ses lettres, qu'il a pris lui-même les renseignements les plus détailés à cet égard, et qu'il n'hésite pas à se déclarer convaincu comme tout le monde"; by SCHMIEDER (9) :

" Nicht minder wichtig ist dass Bezeugniss des berühmten Benedikt Spinoza, welcher die von Schweitzer gemachte Erfahrung aufmerksam untersuchte."; and by LEWINSTEIN (10) :

" Wie grosses Aufsehn diese Projection machte, und wie allgemein sie geglaubt wurde, zeigt der Umstand, dass Benedict Spinoza, welcher doch gewiss nicht zu den leichtgläubigen Leuten zählt, für die Richtigkeit der Sache eintrat."

Even as late as December 30th, 1930, we find that : ... " Spinoza believed that Helvetius, the physician to the Prince of Orange, had been given a minute crumb of the philosophers' stone by

(6) WACKENRODER, *Historische Skizze der Alchemie*, p. 24, Lemgo (1838).
(7) KOPP, *Geschichte der Chemie*, ii, p. 170, Braunschweig (1843).
(8) FIGUIER, *L'Alchimie et les Alchimistes...*, p. 213, Paris (1856).
(9) SCHMIEDER, *Geschichte der Alchemie*, p. 427, Halle (1832).
(10) LEWINSTEIN, *Die Alchemie und die Alchemisten*, p. 24, Berlin (1870).

an unknown stranger at The Hague in the year 1666, and had made gold."—a statement by SLATER in his article entitled " Makers of Gold," which appeared in the *Daily Telegraph* of that date. It must therefore be realized that these far-reaching and probably interdependent deductions are based only on a letter of SPINOZA's dated 25 of March, 1667, and addressed to JARIG JELLES (11), which reads as follows :

"I have duly received your last letter written on the fourteenth of this current month, but, owing to various hindrances, I could not answer it sooner. With regard to the matter relating to Helvetius, I have spoken about it with Mr. Vossius who (not to relate in a letter all that we said to each other) ridiculed it greatly, and expressed surprise that I should inquire of him about such a trivial thing. Taking no notice of this I went nevertheless to the silversmith, named Brechtelt, who had tested the gold. But he, speaking very differently from Vossius, said that between smelting and separation the gold had increased in weight and had become heavier by as much as the weight of the silver that he had put into the smelting crucible for the purpose of the separation. Therefore he firmly believed that this gold which transmuted his silver into gold, contained something uncommon. He was not the only one who found this so, but various other men who were present at that time did so too. After this, I went to Helvetius himself, who showed me the gold and the crucible which was still gilded on the inside, and said to me that he had thrown into the melted lead not more than about one fourth part of a grain of barley or of mustard seed. He added that within a short time he would publish an account of the whole matter, and further said that at Amsterdam a man (and he thought it was the same man as had called on him) had performed the same operation, of which you will doubtless have heard. This is all that I was able to learn about this matter."

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(11) WILLIS, *Benedict De Spinoza : his Life, Correspondence and Ethics*, p. 332, London (1870); WOLF, *The Correspondence of Spinoza*..., p. 232, London (1928). A German translation of this letter is given by SCHMIEDER, *loc. cit.*, p. 427 and a French one by FIGUIER, *loc. cit.*, p. 213, who wrongly gives the date of the letter as March 27th 1667. The original Latin version is reproduced by KOPP, *Die Alchemie*..., i, p. 232, Heidelberg (1886); For an interesting sketch of the life of JELLES see WILLIS, *loc. cit.*, pp. 111 to 115.

Although SPINOZA seems to have shown sufficient interest in HELVETIUS's claim to make inquiries about it, there is no doubt whatever that previous writers have been carried away in their statements that SPINOZA had *confirmed* the transmutation experiment. He states in a letter to SCHULLER (12) dated 18 November 1675 :

" Lastly, I have not yet attempted to make trial of the process of your kinsman, nor do I believe that I shall be able to apply my mind to the attempt. For the more I consider the thing itself, the more I am persuaded that you have not made gold, but had not sufficiently separeted what was latent in the antimony. But more of this on another occasion; now I am prevented for want of time."

No further reference to transmutation can be found in SPINOZA's correspondence and his support looked for by the believers in transmutation may be finally dismissed. SPINOZA obviously neither believed in nor supported transmutation—the only inference to be drawn from these two letters.

The University,
Bristol, England.

M. NIERENSTEIN.

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(12) WOLF, *loc. cit.*, p. 342; see also LIPPMANN, *Entstehung und Ausbreitung der Alchemie*, ii, p. 21, Berlin (1931).

Early Evolution of Power Engineering (*)

For half a million years or more man has sought to augment his own bodily power, first with sticks and stones which gave him the mechanical advantage of the lever and the wedge; then, after a vast lapse of time, by means of simple mechanisms operated by man and animal power; and, finally, by an ever increasing control over the forces of Nature.

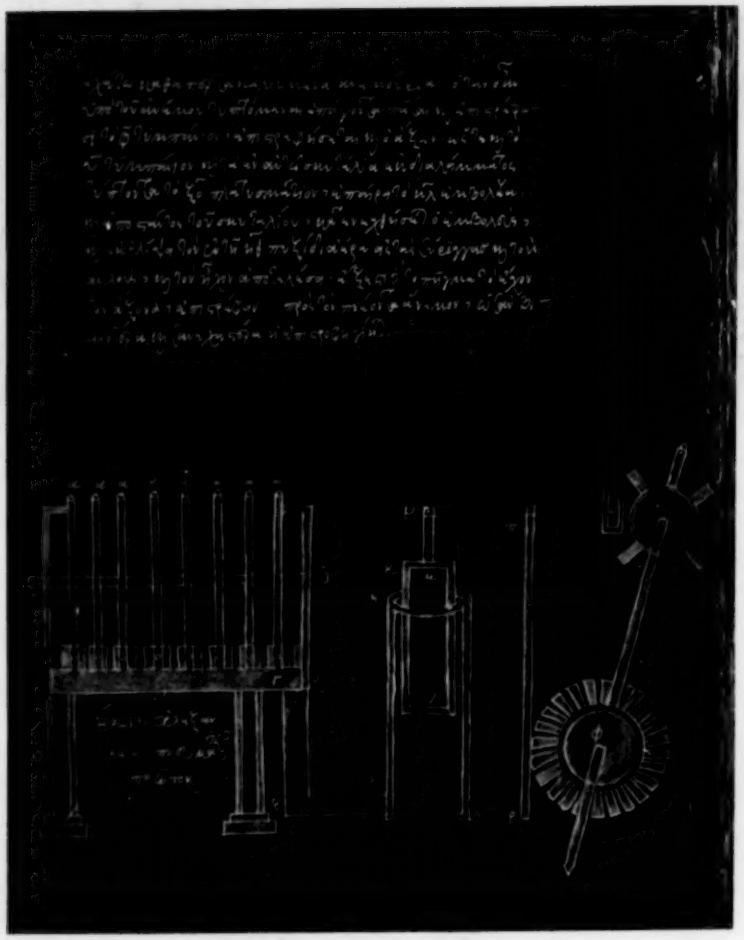
But though from the earliest times he has shown those tendencies which were eventually to make him an engineer, it is only during the past seven thousand years or so that we find any evidence of his attempts to harness external power. It is probably in the same relatively short period that he has invented the wheel and axle, and developed rotary motion beyond such early application as the fire drill rotated between the palms of the hands, or by means of a bow. The earliest illustration of the wheel and axle that can be approximately dated appears in a Sumerian plaque of between five and six thousand years ago. The invention of the wheel and axle is a matter of the highest importance in its bearing on the trend of engineering evolution. We cannot say when or where this significant development took place, but it is interesting to note that in the earliest known document in Sumerian writing we find a pictograph not of a wheeled chariot but of a sledge with a roller placed in front of it. (1) It may be, therefore, that the wheel and axle were invented in the fourth millennium B.C.; at least so far as the Sumerians are concerned. Certainly I incline to believe that this was an Asiatic invention. It was unknown in Egypt until the Hyksos occupation, about 1700 B.C. Of other applications of rotary motion the cylinder

(*) Paper presented to the *British Association for the Advancement of Science*, section H., London, September 29, 1931.

(1) SIDNEY SMITH, *Early History of Assyria*, p. 11.

No 1. Tipping beam water mill (pestle and mortar); see p. 414. From Korea.
Photograph by courtesy of Mr. H. GLENDINNING.

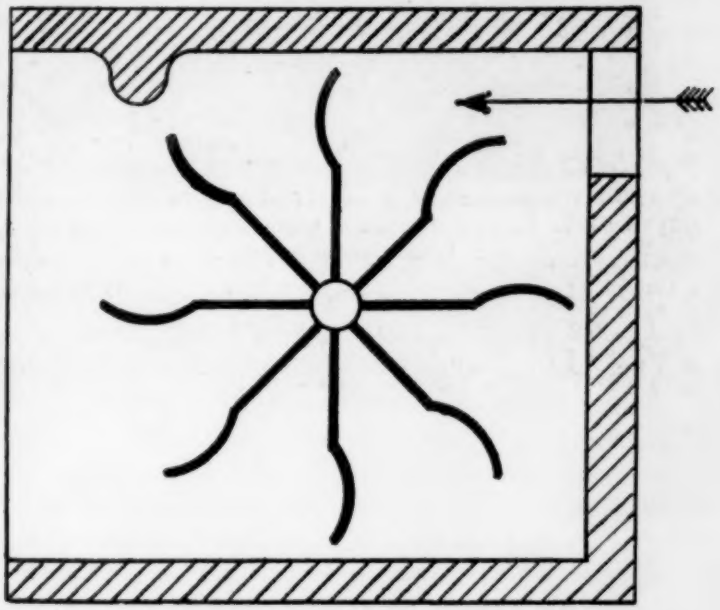
No 2. Pestle and mortar water wheel; see p. 415. From Kashgar.
Photograph by courtesy of Capt. G. SHERRIFF, Kashgar.



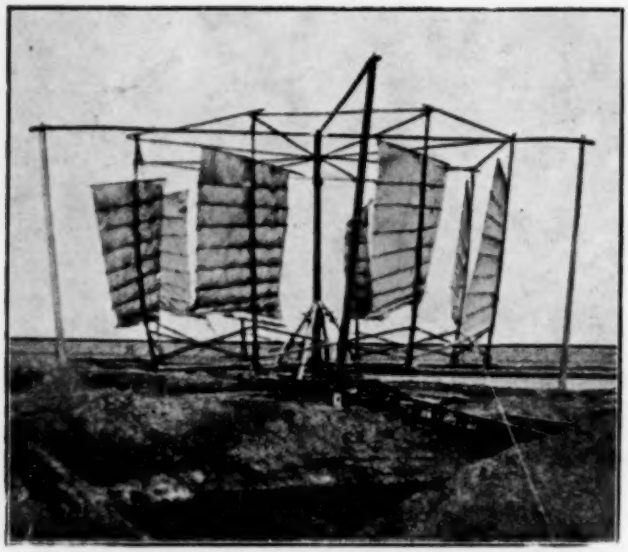
No 3. Photostat of one of the four MSS. (no. « Burney 108 ») in the British Museum of HERON's Pneumatics.

Isis, XVII, pl. 23 H. P. VOWLES.

No 4. Seistani windmills, present day. Photograph by courtesy of Lt.-Col. R. L. KENNION, C.I.E., late British Consul-General, Seistan.



No 5. Diagrammatic cross-section of a Persian windmill.



No 6. Chinese windmill, p. 295 of *Farmers of Forty Centuries* by F. H. KING, D. Sc., late of Wisconsin University and U.S. Department of Agriculture.

H. P. VOWLES.

seal is said by Mr. HALL to be more at home in Sumerian than Egyptian culture, and according to Mr. WOOLLEY the potter's wheel was known to the potters of Ur before it was used in Egypt. Again, according to Sir FLINDERS PETRIE, the Egyptians did not use the lathe, being content to imitate by hand the lathe products of Syria; while the earliest known representation of a pulley comes from Assyria. It is noteworthy too that the Assyrians used rollers under their sledges for moving heavy objects; whereas the Egyptians appear to have been ignorant of, or content to do without, this aid to transport.

Speaking generally, it may be said that the invention of the wheel necessarily preceded the harnessing of external power, the only exception of importance being utilisation of the wind for ship propulsion, a step already taken in pre-dynastic Egypt. We do not know with certainty what the next steps were, but we can say with confidence that they were associated with two of man's most fundamental needs; water for irrigation and consumption, and flour for his daily bread. Such evidence as is available points to the water-raising wheel, turned by the flow of a river, as being the second notable advance made by man in utilising the forces of Nature. Irrigation machines are referred to in Babylonian inscriptions, but without details of their construction and operation. Nevertheless, in view of the very primitive nature of some of the water-rotated wheels still in use on the Euphrates, also in Syria, Persia, China, and elsewhere, it is not unreasonable to believe that water power had been harnessed for irrigation purposes even in Sumerian times. KING, in his *History of Babylon*, supports this view (2), and there is in the *Cambridge Ancient History* an interesting reference to a Sumerian month known as the « Month for raising the Water Wheels, » though we cannot be sure that these wheels were turned by the flow of the river. The earliest description of wheels of this type that I have been able to trace occurs in VITRUVIUS.

Many of the water-raising wheels still to be seen on the Euphrates are more primitive than those of which I have illustrations from other parts of Asia. The wheel is constructed of branches fastened together, with spokes joining the outer rims to a roughly hewn

(2) Vol. I, p. 461.

axle. Earthenware vessels, for picking up the water, are tied to the outer rim, paddles being also affixed to the rim so that the wheel may be turned by the river as it flows past. The wheel is commonly placed near the bank of the river, its axle rotating in walls of primitively built masonry. As the current turns the wheel, the vessels at the rim pick up the water when dipping below the surface, emptying themselves into a trough as they turn over at the top. From the trough the water is led away as required. At Hit there is a line of these wheels, 35 feet high, which creak and groan incessantly as they turn with the current. Elsewhere in Asia, notably in Syria and China, they are sometimes from sixty to eighty feet in diameter.

Before the water-raising wheel could be adapted to drive millstones rotating on a vertical axis, such as we know were used in Roman times and are still extensively used to-day, toothed wheels had to be invented.

HERON OF ALEXANDRIA, who may have lived in the first century A.D., refers to a toothed wheel mechanism in his *Pneumatics*, and PAPPUS a century or two later describes a toothed wheel rotating on a helix such as we now call worm gearing. According to ATHENAEUS, a helix was used by ARCHIMEDES to launch the ship which HIERON OF SYRACUSE had had built for king PTOLEMY. VITRUVIUS, who also makes various references to toothed wheels, states that CTESIBIUS used them in some of his mechanical devices. This takes us back to the third century B.C., but beyond that I cannot go. The question arises: Was some kind of water operated mechanism for corn milling devised before the geared mill (also described by VITRUVIUS) was invented?

There are in use to-day three primitive types of watermill, none of which necessitates toothed wheels. One of these does not include a wheel of any kind. It is to be seen in China and Korea, and consists of a pivoted beam, one end longer than the other; the longer end having a pestle affixed to it, while the shorter end is hollowed out, and is placed so that a stream of water flows over it. When the hollowed part is full of water, that end descends, raising the pestle at the other end. This spills the water, and the pestle then descends by its own weight into a mortar containing grain or rice. This process is repeated indefinitely. Hand-operated pestles were used in ancient Egyptian times, and are

still used for pounding wheat and husking rice. Foot-operated pestles are also used in China. (3) The water-operated device to which reference has just been made may well have been one of the earliest applications of water power, but of this I can find no evidence in the literature of antiquity.

A second primitive type of watermill consists of a horizontal wheel on a vertical axis. The wheel is attached to the lower end of the axle, while the upper of two millstones is fixed to the top. The nether millstone, as usual, is a fixture. Grain trickles from a hopper through an aperture in the centre of the rotating stone, the flour emerging from between the stones at the rim. Such mills are used, or have been used until recently, in Shetland, Norway, Roumania, Greece, the Caucasus, Persia, Turkestan, Thibet, China, and elsewhere; but for this mill also I can find no evidence in the literature of Graeco-Roman times. It has been called the « Greek » mill, with the implication that it was known in antiquity, but this I believe is without foundation other than that afforded by its primitive construction.

For the early origin of the third type of mill without gearing there is I think written evidence, though not so satisfactory as one could wish. This mill consists of an undershot water-wheel on an extended axle, operating pestles by means of a « trip-hammer » mechanism. From the axle there project pegs which, as the axle rotates, depress the short ends of pivoted levers. Further rotation of the axle frees the levers in turn, whereupon the other ends, carrying pestles, fall into mortars containing wheat or rice. Water-mills of this kind are still used in Turkestan, Thibet, and China. They are, I believe, mentioned in PLINY's *Natural History*. After referring to what are evidently hand-operated pestles for pounding grain, Pliny remarks : « Major pars Italiae ruido pilo : rotis etiam quas aqua verset obiter, et molat. » (4) This has been translated : « In the greater part of Italy is used a roughened pestle, with wheels also which the water turns in passing, and so it grinds. » Professor D'ARCY THOMPSON F. R. S. is of opinion, however, that « ruido pilo » does not mean roughened pestle, but is equivalent to « ruente pilo », and means a falling pestle. Further evidence

(3) See illustration p. 397, vol. II of STAUNTON's *Embassy to China*.
(4) *Nat. Hist.* XVIII, 23.

of this type of mechanism in antiquity is afforded by HERON OF ALEXANDRIA, who as I shall indicate presently, describes and illustrates a similar method of transmitting power. Bearing these facts in mind, and having regard to the primitive nature of this type of mill, I think we are justified in concluding that it represents one of the earliest applications of water power to the needs of mankind.

I referred a moment ago to HERON OF ALEXANDRIA. HERON describes and illustrates in the *Pneumatics* an organ in which air under pressure is delivered to the pipes by the agency of wind power. For some time I was doubtful whether HERON actually refers to the use of a windmill for this purpose. There are one or two obscurities in the Greek text, and I felt sceptical about the practicability of the apparatus which he describes. Since then, however, I have changed my views. It seems impossible to put any other rational interpretation on HERON's text; I have made a rough working model of his apparatus; and this, together with the fact that PLINY appears to indicate the existence in those early times of the same kind of trip mechanism, now makes me inclined to believe that HERON did have knowledge of the possibility of obtaining rotary motion by means of vanes or sails acted upon by the wind. The matter is of importance in the history of power engineering, as, if this conclusion is correct, it indicates that the windmill was invented at a much earlier time than has hitherto been generally realized.

HERON's mechanism differs from the pestle and mortar waterwheel in having a windwheel substituted for the waterwheel, and a piston descending in a cylinder by its own weight substituted for a pestle falling into a mortar. The reciprocatory motion of the piston, caused by the pegs on the wheel shaft striking the pivoted lever, results in air under pressure being delivered to the organ pipes.

It may be suggested in passing that toothed wheels, which now play such an important part in the transmission of power, developed out of pegs projecting from an axle, as indicated by HERON, and as used in the pestle and mortar watermill. The following slide shows one shaft driving another by means of four pegs projecting from each, the pegs on one shaft engaging in turn with the pegs on the other. The author of the work from which

the illustration is taken, writing in 1842, states that this arrangement was commonly used in Spain in his time. (5) It can scarcely be doubted that toothed wheels were originally evolved from some such simple arrangement as this.

Apart from HERON's *Pneumatics*, the earliest authentic reference to windmills occurs in the tenth century. This is in a work written in Arabic by AL-MAS'ŪDĪ, who refers to windmills existing in his time in Sidjistan, now called Seistan. He also relates a story which if authentic would indicate that windmills were known in Persia as early as the 7th century A.D. I can find no contemporary evidence for this : it does not, however, seem to me to be improbable. That windmills were known in the tenth century is indicated by another writer of the time, EBN HAWQAL, and as windmills of a very primitive type are still used in Seistan and neighbouring parts of Persia, we may conclude that the 10th century windmill was similar in construction to the Persian windmills of to-day.

It will be seen that these windmills are very different from those with which we are familiar in Europe. The mills, which are used for grinding wheat and barley, and in times gone by were used for irrigation purposes, have walls of stone and sun-dried brick, and are built in rows like a row of houses. Vanes constructed of reeds are driven round a vertical axis. The wind very conveniently blows in one direction only in Seistan—north-north-west—so that there is no need for any device to swing the mill round as in the case of the European mill which has to follow a veering wind. The wind blows in through a gap at one side of the structure, and out again through a larger gap on the other side. The vanes as they return are sheltered from the wind by the construction of the mill walls. The upper end of the axle runs in a cross beam supported by the walls, while the lower end is attached to a mill stone in the mill room below the floor : a trough being placed beneath the millstones, to receive the flour. It may be noted that the wind in Seistan has been registered in the month of June to blow at the rate of 72 miles an hour.

I have referred to the Persian windmill at some length because it seems to me to be definitely nearer to the origins of power

(5) See EWBANK, *Hydraulics and Mechanics* (New York, 1842), p. 114.

engineering than are European windmills, which are more complex in construction, and for which we have no authentic evidence earlier than the 12th century A.D.

But there is yet another Oriental windmill, quite different from the Persian, which must also be described since this also may represent an early stage in the utilisation of power. In some ways it seems to have been adapted directly from the earliest of all wind power devices, since the sails are constructed and hung in much the same manner as those of a sailing ship. These mills are used in China, particularly in the windy coast provinces between Shanghai and Pekin. (6) At the government salt works near Tientsin they are used for pumping brine by means of a chain pump. They consist usually of eight sails, each about 6 feet by 10 feet, hung so as to rotate about a vertical axis. The sails are so arranged as to tilt automatically and present an edge only to the wind on the returning side of the mill. It will be seen that the mill works no matter which way the wind happens to be blowing. I have endeavoured to trace the origins of this type of windmill, but can only get back to the 17th century, when I find them mentioned and illustrated in NIEUHOFF's *Embassy.... delivered at Peking*. (7) It may therefore have been introduced from some other country, but if so it has left no trace elsewhere that I can discover.

For the origins of steam power we again have to go back, as is well known, to HERON OF ALEXANDRIA. HERON described what was in effect a small impulse turbine. He also described a similar method of obtaining rotary motion by means of hot air in the place of steam. HERON's steam turbine has been called a « whirling eolipile », and as the stationary eolipile has been certainly used to generate a steam blast for close on two thousand years, and probably for much longer than that, I think HERON may very well have derived his idea from this apparatus. The stationary eolipile as commonly constructed consisted of a globular vessel of brass or other metal, with a narrow neck through which the steam issued. The vessel was filled with water and placed over the fire. Steam from apparatus of this kind has been used for

(6) *Farmers of forty centuries*, F. H. KING, pp. 293-295.
(7) Vol. I, pp. 84, 85.

many purposes, as a substitute for bellows in ordinary grates and in smelting furnaces, for increasing the draft of chimneys, to blow organs, and to disperse perfumes. VITRUVIUS refers to them as though they were in common use in his time. There is scarcely an alchemist or experimenter of medieval times who does not refer to them, so widely were they used where a blast was required. Bishop WILKINS mentions them in connection with the « melting of glasses or metals. » KIRCHER (8) tells us how to turn a joint of meat before the fire by means of an eolipile. And it was through experiments with eolipiles that investigators like JEROME CARDAN and BAPTISTA PORTA learned that a vacuum may be readily procured by the condensation of steam, and that liquids may be raised by this means. Had the alchemists been interested in raising large quantities of water by steam, they could scarcely have failed to produce a steam-engine similar to SAVERY's, since every element of it was in their possession and in constant use.

For many centuries after the time of HERON I can find only casual references to the use of steam. It was not until after the European development of printing in the fifteenth century, and the translation of HERON's *Pneumatics* into Latin and Italian in the latter half of the 16th century, that the stage was set for the experiments and practical developments of PORTA, DECAUS, KIRCHER, BRANCA, PAPIN, WORCESTER, SAVERY, NEWCOMEN, and JAMES WATT. The increasing interest in science and discovery in the 17th century, the foundation of the Royal Society in 1662, the fact that scientific works began to appear in English about this time, the growing demand for coal and for some more powerful means of raising water from mines,—all combined to usher in the age of steam. Yet even when a practical steam engine had been evolved, it was at first used extensively as a mere adjunct to the water-wheel, particularly by JOHN SMEATON; the engine being used to ensure a steadier supply of water to existing watermills.

Time will not permit me to refer in any detail to the origins of man's knowledge of magnetic and electrical phenomena. THALES in the 6th century B.C. is said by later writers to have been the first to mention the attractive property of amber. (9) A Hindu

(8) *Mundus Subterraneus*, vol. I, p. 203.
(9) DIOG. LAERT. I, 24.

philosopher of the same century, SUSRUTA, is credited with having made use of the magnet for surgical purposes. (10) References to the attractive properties of either amber or loadstone or both are to be found in a number of classical Greek and Roman works, as for example the works of PLATO, ARISTOTLE, THEOPHRASTUS, PLINY, DIOSCORIDES, LUCRETIUS, and others. The knowledge of antiquity in these matters was very limited, being confined to simple and often very vague comments on amber, loadstone, and materials with similar properties; some observations on lightning and St. Elmo's fire by SENECA; and reference by ARISTOTLE and others to the ability of the fish known as a torpedo to administer shocks. The earliest known attempts to investigate the properties of the magnet intelligently were made by PETRUS PEREGRINUS DE MARICOURT in the 13th century A.D. PETRUS also gives the earliest known illustration of a pivoted compass; though according to HIRTH the mariner's compass would appear to have had its origins in China, as indeed has long been suspected. After PETRUS PEREGRINUS we come to GILBERT in the 16th century, and so down to an ever increasing knowledge of magneto-electric phenomena; culminating at last in the epoch-making discoveries of MICHAEL FARADAY, and the marvellous electric power developments of the age in which we live.

Wimbledon, Engl. HUGH P. VOWLES.

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(10) SARTON, *Introduction to the History of Science*, vol. 1, p. 77.

Notes and Correspondence

I. History of Science.

VII^e Congrès International des Sciences Historiques. Section d'Histoire des Sciences et de la Médicine. — *Deuxième communiqué de la Commission Organisatrice.* — Dans le communiqué précédent (voir *Isis*, 16, 129-130) la Commission Organisatrice a rendu compte de ses travaux couvrant la période mai-décembre 1930. Aujourd'hui, il nous paraît utile de donner avant tout quelques informations d'ordre général sur l'organisation du VII^e Congrès International des Sciences Historiques.

Le Congrès se tiendra à Varsovie entre le 21 et le 28 août 1933 et comprendra quatorze sections dont la 9^e sera consacrée à l'histoire des sciences et de la médecine. Pour les sujets qui seraient susceptibles d'intéresser les membres de plusieurs sections, on envisagera la possibilité d'établir des séances communes.

Les contributions à apporter au Congrès seront de trois espèces : les rapports, les communications et les interventions.

1. Est recommandé spécialement pour les sujets les plus complexes l'établissement de *rapports* présentant une mise au point et susceptibles de servir de base, d'abord pour une discussion des détails à éclaircir, ensuite pour le développement des recherches. Les rapports devront être prêts avant le 1^er septembre 1932 de façon à pouvoir être publiés assez tôt avant le Congrès; leur étendue ne doit dépasser 16 pages in-8°.

(En ce qui concerne la 9^e section, on prévoit des rapports synthétiques sur l'histoire des sciences en Hongrie, en Pologne, en Roumanie et en Tchécoslovaquie; voir le premier communiqué de la Commission).

Pour avoir leur pleine utilité, les rapports, dont il ne sera d'ailleurs pas donné lecture au Congrès, devront être, autant que possible, accompagnés de communications portant sur certaines parties des sujets traités dans les rapports.

2. Les *communications* sont la seconde forme de contributions à apporter au Congrès, la forme traditionnelle. En principe, les communications seront libres; mais il est recommandé aux auteurs, s'ils ne traitent pas les questions entrant dans les rapports, de choisir des sujets assez larges

ou qui présentent, tout au moins, un intérêt réel pour l'histoire générale.

(En ce qui concerne la 9e section, nous rappelons que le Comité International d'Histoire des Sciences a choisi, comme sujet principal de la discussion, l'histoire des sciences au XVIe siècle; par conséquent, les thèmes des communications doivent se rapporter, autant que possible, à l'histoire de la pensée scientifique de cette époque).

Chaque congressiste ne sera admis, en principe, à présenter qu'une communication. En outre, le Comité Organisateur se réserve le droit de décider en dernier ressort de l'accueil à faire aux communications qui lui seront transmises.

Les résumés des communications (2—4 pages au maximum) devant être imprimés avant le Congrès, ils seront obligatoirement adressés avant le 1er mars 1933 au Comité Organisateur (ou à la Commission Organisatrice de notre Section.)

3. C'est pour préparer le mieux possible la discussion des rapports et des communications, qu'on introduit une troisième forme de contributions à l'œuvre du Congrès. Elle consistera dans des *interventions* annoncées à l'avance, pour la discussion des questions figurant à l'ordre du jour du Congrès. Il sera fait mention de ces interventions dans l'ordre du jour de chaque séance et dans le compte-rendu général du Congrès.

Le Bureau du Comité Organisateur a son siège à l'Université de Varsovie (M. THADÉE MANTEUFFEL, secrétaire). —

En second lieu, nous avons le plaisir d'annoncer que le Groupe National Tchécoslovaque du Comité International d'Histoire des Sciences a constitué une commission chargée de préparer la participation de son pays aux travaux de la Section d'Histoire des Sciences et de la Médecine au Congrès de Varsovie. Elle se compose des MM. KOLIHA, KOMÁREK, KRATOCHVÍL, PROCHÁZKA, SCHÄFERNA, SEYDL, VEJŠICKÝ et VETTER. Le rapport général sur *L'histoire des sciences en Tchécoslovaquie* sera élaboré par M. Q. VETTER (Prague); les communications particulières sur l'histoire de chaque science seront probablement réunies dans une publication spéciale qui, en même temps, servira de guide à la partie tchécoslovaque de l'exposition projetée.

De même, la participation de la Roumanie sera organisée par le Groupe National Roumain du C. I. H. S. (MM. BOLOGA, JORGA et SERGESCU). Le rapport sur *L'histoire des sciences mathématiques et physiques en Roumanie* sera fait par M. P. SERGESCU (Cluj), celui sur *L'histoire des sciences naturelles et de la médecine en Roumanie* par M. V. L. BOLOGA (Cluj).

Les rapports sur *L'histoire des mathématiques, de la physique et de l'astronomie en Hongrie* seront préparés par MM. A. SZÜCS, B. POGÁNY et A. TASS (Budapest).

La liste des rapports et des communications annoncés à la Commission,

publiée dans notre communiqué précédent, s'est augmentée en outre des titres suivants :

10. R. ALMAGIÀ (Rome) *Ciò che è definitivamente aquisito alla scienza e ciò che ancora può essere utilmente indagato intorno ai viaggi ed alle scoperte di Cristoforo Colombo ed alle conseguenze riguardo al progresso della scienza.*

11. E. BORTOLOTTI (Bologne) : *La storia delle scienze matematiche in Italia nel sec. XVI.*

12. E. STAMM (Strzyżów) : *La géométrie de Nicolas Copernic.*

13. J. TRICOT-ROYER (Anvers) : *Un chapitre de l'histoire de la lèpre en Belgique au XVI^e siècle.*

Dans sa réunion du 27 avril 1931 la Commission a jugé convenable de s'adjoindre M. F. KUCHARZEWSKI (Varsovie).

Varsovie-Cracovie, au mois de juin 1931.

A. BIRKENMAJER, *secrétaire*
Cracovie, Garbarska 7 A

S. DICKSTEIN, *président*
Varsovie, Marszalkowska 117

Comité International d'Histoire des Sciences.

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(du 5 juillet 1931 jusqu'en 1934)

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COMMISSION ORGANISATRICE DU TROISIÈME CONGRÈS INTERNATIONAL D'HISTOIRE DES SCIENCES : BERLIN 1934

Karl Sudhoff, *président.*
Aldo Mieli, *secrétaire perpétuel.*
(La Commission sera bientôt complétée par le président).

COMMISSION ORGANISATRICE DE LA SECTION D'HISTOIRE DES SCIENCES ET DE LA MÉDECINE AU CONGRÈS INTERNATIONAL DES SCIENCES HISTORIQUES DE WARSZAWA
(21-28 août 1933)

Samuel Dickstein, Warszawa, *président.*
Aldo Mieli, Paris, *secrétaire perpétuel du Comité.*
V. L. Bologa, Cluj. — W. Bugiel, Paris. — P. Diepgen, Berlin. — T. von György, Budapest. — Ch. Singer, London. — W. Szumowski, Kraków. — J. Talko-Hryncewics, Kraków. — J. Tricot-Royer, Anvers. — Q. Vetter, Praha. — A. Wrzosek, Poznañ. — L. Zembrzuski, Warszawa. — L. Ziembicki, Lwów.
Alexander Birkenmajer, Kraków, *secrétaire.*

Japanese Astronomy in Past and Present. — *Lecture delivered on July* 24, 1931, at Kyoto, by Issei Yamamoto.

Chapter I. Ancient Age.

Mythological : i. God Izanagi invented three heaven calendar.
ii. First Emp. Zinmu determined the New Year.

Chapter II. Under Chinese influences.

i. Emp. TENTI (662-672). Clepsydra invented. Observatory built.

ii. Taiho statute (701).

Bureau of astrology : Astrology, astronomy, calendar, mathematics, clepsydra.

iii. Official calendars :

(1) Genka-calendar,	A.D. 692-697.	SUNG, 445 A.D.
(2) Giho-calendar,	697-763.	TANG, 677
(3) Taien-calendar,	763-858.	» 728
(4) Goki-calendar,	858-861.	» 764
(5) Senmei-calendar,	861-1684.	» 822
(6) Daito-calendar,	1684-1685.	MING
(7) Teikyo-calendar,	1685-1754.	
(8) Horeki-calendar,	1754-1797.	
(9) Kwansei-calendar,	1797-1842.	
(10) Tenpo-calendar,	1842-1872.	
(11) The Solar calendar,	(1872).	
(12) The Gregorian calendar	(1900).	

iv. Court astronomers.

KAMO-YASUNORI.....calendar & astronomy.

Calendar : KAMO-MITUHISA &c. (-1557), SATOI (1615-).

Astrology : ABE-HARUAKI &c.

TUTIMIKADO &c.

Cosmological philosophy :

Dualism, « In-yo » theory (Sun-moon, positive-negative, &c).

Pentalism. « Five element theory ».

Plant, fire, earth, metal, water.

Sexagesimal cycles :

Ten orders.

Twelve signs.

Chapter III. Under Dutch influences.

Prelude : A.D. 1549. FRANCIS XAVIER reached Kagosima.
1574-1583. ODA-NOBUNAGA, chief executive.
1585-1614. Persecution... prohibition.
1639. Complete seclusion.

Dutch influences :

Nagasaki interpreters,	NISI, MOTOGI, &c.
Bungo group,	MIURA, YAMAGATA, SIZUKI, HOASI.
Osaka astronomers,	ASADA, TAKAHASI, HAZAMA.
Yedo amateurs,	KOBAYASI, NISIKAWA, OTUKI.

Patron, SHOGUN TOKUGAWA-YOSIMUNE (1716-1744).

Geodesist, INO-TADAYOSI (1744-1821).

Official astronomers at Yedo :

i.	SIBUKAWA,	12 gen.	(1683-1860:)
ii.	IKAI,	1 »	(1716-1741:)
iii.	NISIKAWA,	3 »	(1741-1760)
iv.	YAMADI,	6 »	(1748-1860:)
v.	YOSIDA,	5 »	(1750-1860:)
vi.	OKUMURA,	2 »	(1765-1811)
vii.	TAKAHASI,	3 »	(1795-1850:)
viii.	ADATI,	3 »	(1796-1860:)
ix.	HAZAMA,	4 »	(1795-)
x.	INO,	3 »	(1796-1827)

Observatories at Yedo :

1.	Honzyo	(1689-1703)
2.	Surugadia	(1703-1715)
3.	Tukizi	(1721-1842:)
4.	Kanda	(1746-1757)
5.	Usigome	(1765-1782)
6.	Asakusa	(1782-)
7.	Kudan	(1842-)

Chapter IV. Modern age.

Bordeaux. — Une chaire d'histoire de la philosophie et des sciences a été créée (1 janvier 1931) à la faculté des lettres de l'université de Bordeaux. Elle est confiée à Mr. HENRI DAUDIN, Dr. es-lettres, titulaire du prix Binoux en 1927 pour ses études d'histoire des sciences naturelles (*Isis*, 10, 502-505).

L. S.

II. Queries and Answers.

Query No. 20.—Conductivity. What is the history of the origin and development of the concept of ' conductivity ' as used in the fields of Heat and Electricity?

ALEX. C. BURR, *Massachusetts Institute of Technology, Cambridge, Mass.*

III. Miscellanea.

A note on Galileo's determination of the height of lunar mountains; with reference to Prof. CAJORI's paper on the History of determinations of the heights of mountains. (1)

(1) CAJORI, *Isis*, 12, 482-514.

1. GALILEO, in his *Sydereus Nuncius* of 1610, announcing his first discoveries by his newly invented telescope, in calculating the height of a lunar mountain (2), the peak of which was just illuminated at half-moon, assumes the diameter of the earth to be 7000 milliaria. If these are the Italian miles of 1480 metres (3), this estimate is 6437 miles (4). PTOLEMY in his Geography had given a degree as 500 official Egyptian stadia (5) of 209.4 metres (6), from which the diameter is 7455 miles. WILLEBRORD SNELL in 1617 determined the degree at 67 miles (7), which gives a diameter of 7678 miles. GALILEO's estimate therefore is further evidence for CAJORI's assertion that 'before the seventeenth century there prevailed extreme uncertainty relating to the size of the earth.' (8)

2. GALILEO's second assumption is that the ratio of the moon's diameter to that of the earth is $\frac{2}{7}$ (= 0.2857). PTOLEMY in his Almagest (9) had given $\frac{17}{60} + \frac{33}{3600}$ (= 0.2925); the modern value being 0.2727.

3. GALILEO observed the distance of the mountain top from the terminator to be $\frac{1}{20}$ of the moon's diameter; so that the height of the mountain would, using his data, be at least 4.988 milliare = 4.587 miles. His words are '*eminentior milliaribus Italicis quatuor*.' Applying the modern value of the moon's diameter to his observation, the height would be at least 5.409 miles. Modern estimates of the highest mountains in the moon reach 4.7 miles.

4. But his concluding words are the most astonishing to modern readers. '*Verum in Tellure nulli extant montes, qui vix ad unius milliaris altitudinem perpendicularem accedant*.' GALILEO's caution is made very evident in the following comparison with the contemporary estimates collected by CAJORI (10) of the greatest heights (max.) and the height of Teneriffe (Ten.) reduced to metres.

ALHAZEN (c. 1000)	14,800 (max.)
CARDAN (c. 1500)	463,000 (max.)
SCALIGER (c. 1580)	90,000 (Ten.)
PATRIZZI (c. 1580)	105,000 (Ten.)
GALILEO (1610)	1,480 (max.)
SNELL (1617)	8,230 (Ten.)

(2) GALILEO, *Opere*, Padua (1744), ii, 10.
(3) CAJORI, *op. cit.*, 495.
(4) 'Miles' in this note denotes English statute miles.
(5) DREYER, *Planetary systems* (1906), 177-8.
(6) DECOURDEMANCHE, *Poids et mesures* (1909), 135.
(7) BERRY, *Hist. of astronomy* (1898), 204.
(8) CAJORI, *loc. cit.*
(9) *Almagest*, lib. v, cap. XVI.
(10) CAJORI, *op. cit.*, 493-5.

VARENIUS (1650)	11,800 (Ten.)
modern	3,710 (Ten.)

Haileybury College, Hertford, England. C. W. ADAMS.

Prix Binoux. 1931. L'Académie des sciences a décerné pour 1931 le prix Binoux (Philosophie et histoire des sciences) à LOUIS DE NUSSAC, sous-bibliothécaire au Museum d'histoire naturelle, pour un ouvrage intitulé " Les débuts d'un savant naturaliste, le prince de l'entomologie, PIERRE ANDRÉ LATREILLE."

L G.

Avis

Étant donné que les prix des livres dans les divers pays d'Europe tendent à s'équilibrer, à partir du 1er janvier 1933 tous les membres de la Société internationale d'Histoire de la Science (History of Science Society) payeront la même cotisation, soit cinq dollars par an.

Toutefois à titre de compromis et pour faciliter la transition, les membres qui n'ont payé jusqu'ici que trois dollars, pourront racheter les cotisations des années 1933, 1934 et 1935 par un paiement de neuf dollars, à condition que ce paiement soit fait *en une seule fois* à M. Guinet (11 Place général Meiser, Bruxelles, Belgique) avant le 1er janvier 1933.

La Direction d'Isis.
31 janvier 1932.

Reviews

Abū Muḥammad ʿAlī ibn Ḥazim al Andalusī. — *The Dove's Neck-ring about Love and Lovers.* Composed by ABŪ MUḤAMMAD ʿALĪ IBN ḤAZIM AL-ANDALUSĪ... Translated from the unique MS. in the University of Leiden, edited by D. K. PÉTROF in 1914, by A. R. NYKL, The Oriental Institute of the University of Chicago. CXXIV+244 p. Paris, PAUL GEUTHNER, 1931.

The Arabic text translated in this book would hardly justify notice in a journal devoted to the history of scientific civilization. For, though it undoubtedly sprang from personal experiences of its author, it belongs to a rhetorically artificial class of Arabic literature and must be read with much historical and sociological imagination before it yields to the non-Arabist a picture of its time and of its author. And even so it is quite possible that its common-places may suggest more to that reader than really lies in them. The author was a great philosophical theologian of an intense personal faith, and here we have him unbending and developing in curiously artificial form an entirely different side of his life and experience.

But the long introduction by Dr. NYKL is an exceedingly valuable contribution to sociological history and to the esthetic history of music and song. Dr. NYKL divides his introduction into four parts : (I) what he calls the Genesis of the Translation. This is an account of his wanderings in southern France, Spain, Morocco, Tunis, more or less in the tracks of IBN ḤAZIM and trying to work back from the popular life of the present to the life which IBN ḤAZIM had known. This investigation meant the whole problem of the poetry and music of Spain in its double relation to the Christian troubadours and the Muslim civilization. IBN ḤAZIM had been in the very midst of all that and the astonishing thing is that Dr. NYKL, a troubadour in his fashion and a " natural," quite unschooled, musician found himself in that same midst as he wandered and listened to the people round him singing and " making music," after its fashion. This part is full of Dr. NYKL's own personality and is none the worse for that ; a troubadour and an interpretation of the troubadours must be personal. (II) He gives the historical background for the book,

A.D. 900-1031. This is eminently necessary but not so brilliantly attractive. (III) We have a statement of the full and tumultuous life of IBN ḤAZIM himself, scholar, lover, administrator, theologian and great in all. (IV) Dr. NYKL returns, and at greatest length of all (pp. LXI-CXX), to poetry on the two sides of the Pyrenees, an examination and defense of the position of the Spanish school which regards Spain as the bridge between the Muslim and the Christian worlds over which passed, in essence, the songs and music of the troubadours into France. The Pyrenees really did not exist, and, just as now there are French Basques and Spanish Basques, so, then, there was a fairly homogeneous popular literature from Spain into France. This study centres naturally round the life and the eleven surviving poems of GUILLAUME IX, Duke of Aquitaine and grandfather of the better known ELEANOR OF AQUITAINE.

But the real contribution lies in Dr. NYKL's personal experiences while he was making his researches on the ground. The problem always has been how the music of the musicians of the East, who used a different scale from that of the West and tuned their lutes in a way which was discord to the musicians of the West, could have passed so easily into the West without any recorded hitch. Dr. NYKL's experience shows how that was possible. He is a troubadour in his fashion and can make verses and sing ; but he does not know a note of music and cannot write down the melodies he hears ; he can only imitate them in song. Thus the little differences of the two systems were ironed out. Dr. NYKL with his voice and ear trained in European song transferred automatically the oriental melodies into those familiar to him. And so it must have been when Spain was the bridge from the East to the West. It was singers who carried the schemes of poetry and melody and not musicians who thought in notes and scales.

This does not mean that for history and language Dr. NYKL is not an exact scholar. He is and he shows it throughout his book, especially in the masses of technical annotation. But he is also a born linguist and on that side many of us Stubengelehrten will envy him. A man who can talk and sing his way from the Basque country to Tunis enjoys great privileges.

D. B. MACDONALD.

Ferdinand Brunot. — *Histoire de la langue française des origines à* 1900. T. VI. Le XVIII^e^ siècle. I^e^ partie. Le mouvement des idées et les vocabulaires techniques. Fascicule 2. La langue des Sciences, par MAX FUCHS; la langue des arts. 340 p. Paris, ARMAND COLIN, 1930. (60 fr.)

A plusieurs reprises, les travaux de F. BRUNOT sur l'histoire de la langue

française ont été signalés ici (vol. 5, 549; 7, 309; 10, 298). *L'Histoire de la langue française* qui comprend actuellement neuf tomes et n'est point encore terminée est un monument de saine érudition et un outil de premier ordre. Le T. VI est consacré au XVIII^e siècle; le premier fascicule étudiait la naissance de la langue de la politique et de l'économie politique et mettait en lumière les progrès des terminologies de l'agriculture, du commerce et de l'industrie. Le second fascicule est consacré au vocabulaire des sciences, des arts (plus particulièrement de la peinture).

« La langue des sciences » (154 p.) est l'œuvre de MAX FUCHS. La dernière phrase de l'introduction en donne l'économie générale : « l'histoire de la langue scientifique au XVIII^e siècle comporte ainsi trois phases principales : la première est celle des premiers contacts de la science et du public, auquel des vulgarisateurs comme RÉAUMUR et l'abbé NOLLET la révèlent; la deuxième est celle de l'élaboration d'une langue technique, dont, à partir de 1751, l'*Encyclopédie* fera connaître les résultats; enfin, dans la troisième, sous l'influence de CONDILLAC, prévaudra une théorie de la langue scientifique systématique, dont la création de la nomenclature chimique de LAVOISIER est une application éclatante et décisive ».

Après avoir montré que DESCARTES et le cartésianisme agissent peu sur la langue, que les innovations proposées par DESARGUES dans son *Brouillon-projet d'un traité des sections coniques* (1639), et d'ailleurs vouées à un échec absolu, montrent que les savants du début du XVII^e siècle étaient loin de soupçonner l'importance et la nature du problème de la langue scientifique, que des savants tels que PASCAL, ROHAULT ne s'intéressent pas au problème de l'expression, et qu'au début du XVIII^e siècle (FURETIÈRE), le vocabulaire est encore très pauvre, confus, l'auteur signale que c'est l'introduction des idées newtoniennes en France qui, si elle ne détermina point l'éclosion de la langue scientifique, la facilita tout au moins; il donne une longue liste de mots anciens oubliés qui sont réhabilités, et note comment entrent dans la langue des termes de métier, et même des termes populaires et dialectaux. Avec l'abbé NOLLET (1743) apparaît enfin une langue technique; l'auteur des *Leçons de physique expérimentale* fait connaître et comprendre bon nombre de noms d'instruments et d'appareils scientifiques, de termes de mathématiques, d'astronomie, de météorologie, de chronologie, de physique, de chimie, d'anatomie, etc. Tout cela n'allait d'ailleurs pas sans résistance des puristes à la tête desquels il faut mettre BUFFON. Les premières vues théoriques sur le vocabulaire scientifique se trouvent dans l'*Encyclopédie*, et surtout dans le *Discours préliminaire* de D'ALEMBERT qui sent le besoin d'une langue scientifique internationale et souhaite sans l'espérer, que l'usage du latin soit rétabli. Avant d'en arriver à la réforme du vocabulaire chimique, M. FUCHS dégage quelques faits de ses observations. « Il y

a, chez les savants du XVIII^e siècle, et surtout après 1750, une tendance fort nette à spécialiser les éléments du langage et à systématiser le vocabulaire. On sent bien que l'idéal serait de se conformer rigoureusement à deux principes essentiels : 1° tout suffixe ou préfixe doit avoir un sens et un seul ; 2° tous les groupements d'idées analogues doivent être exprimés par des mots de même type. De là une aversion marquée pour la composition populaire trop capricieuse et trop imprécise, et un retour vers ce qu'on pourrait appeler les deux langues savantes internationales. Ce retour s'effectue sous deux formes : indirectement par la résurrection du français savant de la Renaissance, directement, par la création d'après les modèles du XVI^e siècle, de nouveaux mots gréco-latins. Toutefois si les savants ne s'embarrassent guère de savoir ce que les beaux esprits penseront de leurs vocables, ils utilisent en revanche tout ce qui, dans la langue courante, est utilisable ; s'ils parlent latin et grec en français, c'est seulement lorsque le français ne peut exprimer correctement ce qu'ils ont à dire ; partout ailleurs ils se bornent, pour exprimer des idées nouvelles, à combiner de nouvelle manière les éléments traditionnels de la langue ».

Le langage scientifique s'est enfin précisé « dans le dernier quart du siècle, lorsque furent posées, presque en même temps, les lois du nouveau langage chimique et celles de la chimie nouvelle ». Profitant des tentatives de spécialisation du langage chimique de LÉMERY, de MACQUER, de BAUMÉ, de BERGMANN, de GUITON DE MORVEAU, de FOURCROY : LAVOISIER, FOURCROY, BERTHOLLET et GUITON DE MORVEAU présentent à l'Académie des Sciences, en 1787, leur *Méthode d'une nomenclature chimique*, qui reçut de la presque unanimité du monde savant un accueil enthousiaste. La science française avait « un instrument d'expression adapté à ses connaissances actuelles et aux légitimes ambitions de son avenir ».

L. G.

Pierre Brunet. — *L'introduction des théories de Newton en France au XVIII^e siècle.* (Avant 1738). VII+355 p. ALBERT BLANCHARD, Paris, 1931.

Les écrits scientifiques jouirent en France dès le début du 18^e siècle d'un prestige que ne dépassa pas le prestige des écrits proprement littéraires ; le succès des œuvres de LÉMERY, de FONTENELLE, du P. CASTEL, de HARTSOEKER, et de PRIVAT DE MOLIÈRES pour ne citer que ces noms alors célèbres, attirait et retenait la curiosité d'un public fort cultivé et avide de tout apprendre. Ce fait généralement laissé dans l'ombre est cependant fort important pour la compréhension de l'esprit général de cette époque ; je ne connais qu'un excellent petit livre de DANIEL

MORNET qui l'ait jusqu'à présent signalé *(Les Sciences de la nature en France au XVIII^e siècle)* ; c'est un premier mérite de l'ouvrage que nous analysons de l'avoir mis en pleine lumière; ce n'est d'ailleurs pas le seul.

M^r BRUNET s'est proposé de rechercher comment le Newtonianisme s'est peu à peu infiltré dans l'esprit des savants français qui ouvertement alors professaient le cartésianisme, et par là même se montraient hostiles à la théorie de l'attraction qui leur semblait une qualité occulte, et à l'hypothèse du vide qu'ils refusaient même de prendre en considération. Un tel ostracisme à priori ne pouvait longtemps durer, et devant le succès évident, prolongé, et assuré des doctrines newtoniennes qui triomphaient en Angleterre, les astronomes et les physiciens du Continent les examinèrent avec plus de bienveillance; ils en vinrent à accepter l'enseignement mathématique du Maître, tout en jugeant sévèrement le système cosmologique qui l'accompagne et qui, aux yeux des non-savants, en fait toute la réalité.

En agissant ainsi, ils se familiarisèrent doucement avec la méthode newtonienne qui perdit de son étrangeté; en comparant le newtonianisme avec le cartésianisme auquel ils étaient attachés, mais qui, sur le terrain proprement scientifique, semblait céder à l'adversaire, ils se préparèrent à accepter que l'attraction telle que NEWTON l'avait définie ait un rôle dans la nature; bref, c'est en combattant NEWTON, en lui résistant de toutes les forces de leur critique qu'ils éprouvèrent toute sa force et préparèrent sa victoire.

M^r BRUNET n'a pas voulu voir de trop loin ni de trop haut ce duel entre les cartésiens et les newtoniens partis les uns et les autres avec un intérêt passionné à la recherche de la vérité; il s'est efforcé de suivre dans l'ordre chronologique la marche de la pensée des savants qui cherchèrent, calculèrent, expérimentèrent, en même temps qu'ils voulaient prendre clairement conscience de la signification de leurs découvertes; il note au jour le jour, avec exactitude et relief, sans se soucier de les ranger dans un ordre logique, les divers problèmes débattus, pour donner une idée aussi exacte que possible des vicissitudes de la science; cette manière de procéder présente à n'en pas douter des inconvénients très sérieux; mais ces inconvénients ne sont-ils pas ceux de la vie scientifique elle-même? Quoiqu'il en soit, en restant continuellement dans le plan de l'actualité, M^r BRUNET a réussi à faire une histoire qui soit réellement et à tout moment contemporaine de son objet.

Nous ne pouvons ici suivre M^r BRUNET dans l'examen de la vie scientifique de l'époque qu'il est parvenu à ressusciter; signalons seulement que de 1700 à 1738, l'astronomie, la physique, la chimie, et la vision spontanée du monde (si l'on ose s'exprimer ainsi) changèrent complète-

ment d'aspect : même les cartésiens endurcis durent mettre la théorie des tourbillons à l'abri des objections que les newtoniens élevaient constamment contre eux; c'est du moins ce qui ressort des plus importants de leurs travaux; à mesure que la lutte se poursuivait ouvertement ou sourdement, le champ de bataille se déplaçait, la perspective scientifique changeait. L'atmosphère, si l'on ose s'exprimer ainsi, devenait plus favorable à NEWTON; cependant lorsqu'un savant de la valeur de MAUPERTUIS laissa soupçonner que les attractions pouvaient avoir quelque réalité, et cela en 1732, il fit de la peine à quelques uns et FONTENELLE, secrétaire perpétuel de l'Académie des Sciences exprima poliment leurs craintes, alors que le cartésianisme de JEAN BERNOULLI, sous l'influence de MAUPERTUIS, tentait d'assimiler une partie de la doctrine newtonienne, et que VOLTAIRE dans ses *Lettres anglaises* affirmait le prestige de NEWTON non seulement en Angleterre, mais aussi sur le continent.

De 1732 à 1738, époque à laquelle *Les Éléments de la philosophie de Newton* publiés par VOLTAIRE firent éclater aux yeux de tous la victoire des attractions qui eurent désormais pour elles l'assentiment de la plupart des astronomes, physiciens, chimistes, ainsi que celle du public cultivé qui alors jouait un grand rôle, les discussions continuèrent; nous ne pouvons nous risquer même à donner une vue d'ensemble de ces discussions auxquelles prirent part tous les savants dont la pensée a compté et laissé une trace dans l'histoire; nous espérons que le travail de Mr BRUNET aura beaucoup de lecteurs et qu'il suscitera chez quelques uns de ceux-ci le désir d'étudier, eux aussi, une période si vivante de l'histoire de la science; nous souhaitons également que Mr BRUNET ne nous fasse pas attendre trop longtemps la suite de l'enquête qu'il a si habilement menée.

Paris. HÉLÈNE METZGER.

F. Dawtrey Drewitt.—*The Note-book of Edward Jenner in the Possession of the Royal College of Physicians of London.* With an Introduction on JENNER's Work as a Naturalist. Oxford University Press, London : HUMPHREY MILFORD. 1931. VIII+49 p., Portrait. Price 3s. 6d.

This note-book in JENNER's own handwriting covers the period from 1787 to 1806. It contains the original notes of his observations on the habits of the cuckoo, the basis of his celebrated paper contributed to the Royal Society, but deferred by them because of their doubts as to the authenticity of his account of the actions of the young cuckoo in shouldering out the eggs and young of the lawful owners of the nest. The greater part of the text is descriptive of hydatids found by him in various organs of different animals. JENNER concluded that these structures, not then known to be the bladder-worm stages of tapeworms,

were source of tubercles and the cause of tuberculosis. From his detailed observations it is evident that he observed both true cysticerci of tapeworms in rabbits, pigs, and cattle, and also true caseous tubercles. He also records the strongyloid thread worms in the bronchi of hogs and nematodes in the lungs of the toad. It is also evident that he detected a multiple *Echinococcus* hydatid in the liver of the sheep as well as the liver fluke. The note-book also contains the account of his autopsies of dogs dying of canine distemper. He found the inflammation of the lungs which attends this infection, but came to no conclusion as to the disease.

The editor gives a valuable summary of the activities in Great Britain in natural history in the latter half of the 18th century, in some of which JENNER shared. The portrait is reproduced from the painting by Sir THOMAS LAWRENCE in the Royal College of Physicians in London.

CHARLES A. KOFOID.

Henning Larsen. — *An Old Icelandic Medical Miscellany.* Det Norske Videnskaps-Akademi i Oslo. 328 p. Oslo, 1931.

This important Icelandic medical document, containing a curious mixture of superstition and medieval medical knowledge, has been edited from a fifteenth century manuscript found in Dublin. Although the medical sections of this book do not add any information about new forms of medical practice or theory, they do show the influence of Continental thought upon the literature of the Scandinavian countries, and in particular the far-reaching influence of the medical men of Salerno. This edition is of still greater value for the study of Old Norse lexicography than for medical history, the editor having added to the Icelandic text and the very excellent translation, many critical footnotes, and an extensive and detailed Glossary at the end of the book.

The contents of the manuscript are divided into seven parts : 1. Charms against hemorrhages and fevers (quite similar to those found in other collections of Danish, Icelandic, and Norwegian works). 2. A short chapter on the depth of the sea. 3. A book of simples (the longest and most important part of the manuscript). 4. An *antidotarium*. 5. A lapidary (giving the medical use of certain gems). 6. A leechbook. 7. A cook book.

The text and translation are preceded by a number of chapters in which the editor discusses at length the sources of the different parts of the work, cites interesting parallels, and shows the relationship between the various manuscripts.

The *Book of simples* is the most valuable section of this work. According to the editor and to Dr. MARIUS KRISTENSEN, it is based

on the *Herbarium* ascribed to HENRIK HARPESTRAENG which in turn was derived in large part from the *Macer Floridus de viribus herbarum* and the *De gradibus simplicium* of CONSTANTINUS AFRICANUS. However after comparing a number of the paragraphs on simples with the descriptions of the same plants given by IBN SĪNĀ in the *Qānūn*, it would seem that this great Arabic compendium of medical lore might have been one of the ultimate sources of the Icelandic *Miscellany*. For instance, the chapters on *Basilica sive Genciana*, and *Rafanus* in the latter are closely paralleled in the *Qānūn* (II, II, chapters 281 and 574) and these are the chapters which Mr. LARSEN says (p. 30) do not go back to Macer and CONSTANTINE, and for which he has not determined any early source. In connection with these two plants it is also interesting to note that the descriptions of them do not correspond to those in the *Gart der Gesundheit* (1485), and the *Physica* ascribed to HILDEGARD VON BINGEN (MIGNE, *Patrologia latina*, 197, col. 1178), nor to other medieval German medical treatises.

It is true that the editor has included a Glossary of drugs at the end of the translation but it is neither complete nor entirely accurate, nor have a number of the best sources for medieval drugs been noticed at all. For instance, *amomum* could not possibly be *Myrtus pimenta* which is a plant of the West Indies, imported into Europe after the period in which this manuscript was written. Because the berries resembled those of the true *amomum* (Round cardamon) they were often substituted for the latter (cf. FLÜCKIGER and HANBURY, *Parmacographia*, 255-56, and the U. S. Dispensatory, 1912, p. 1248). Neither can *Myrtus pimenta* be the same as *Grana paradisi* which are the product of *Amomum Melegueta* of Western Africa and were often substituted for round cardamom seeds. The *amomum* of the *Icelandic Miscellany* may very possibly be these *Grana paradisi*, because in the late middle ages, this latter name was given to the *Koraarima cardomum* (often called *Cardomum maius*) which came from Eastern Africa and was the plant under the name *amomum*, used by Arabic physicians instead of round cardamon. IBN SĪNĀ gives a very good description of several kinds of *amomum* plants (*op. cit.*, II, II, 51), " De Amomo. Amomum quid est : Est arbor sicut botrus ligni involutus, seu connexus : et habet florem similem (folio indo) in colore et eius folia sunt sicut folia vitis alba : quorum color est sicut aurum : et color ligni eius est sicut hyacinthi, boni odoris : et est eius species viridis et grossa nascens in locis hymidis : et eius odor est sicut odor rutae. Et est species Aegyptica, quae non est longa, neque lata, neque debilis, neque gravis ad frangendum, immo botralis, seu racemo vuae similis, et eius odor exubarat super transituum viae."

Cumin, also, has been confused with *cariu*, which has been correctly

given as *Carum carvi*, caraway seeds. However, *Cuminum cyminum*, cumin, is a separate plant although " it has a taste analogous to but far less disagreeable than that of caraway," (FLÜCKIGER and HANBURY, *op. cit.*, 296). Cumin was one of the most widely known drugs of the middle ages.

In other cases the editor has not identified drugs which were well known in medieval *pharmacopeia*, some of which are as follows : *Ameos*, *Ammi copticum*, true bishop's weed. The seeds of *Ammi maius* and *Sison amomum* were often substituted for the seeds of this plant by medieval writers, cf. FLÜCKIGER and HANBURY, 271 ; *New London Dispensatory*, 31*a*, 142*a* and *b* ; DIOSCORIDES, III, 59 ; IBN SĪNĀ, II, II, 60. Again *Brassica*, plants of the cabbage family ; several kinds are listed by H. FISCHER, *Mittelalterliche Pflanzenkunde*, p. 262. A description of the plant and its properties very similar to those of FISCHER and the *Icelandic Miscellany* is given by IBN SĪNĀ (*op. cit.*, II, II, 139) " De Caule. i. Brassica."

Other words listed as unknown may be simply misspelled names of well known drugs. For instance might not the " bark *oderam* " be *Cortex ordeum*, i.e. barley husk? In the *Gart der Gesundheit* (CCLXXXIX) a plaster of barley meal was recommended for fever, and in the *Physica* of HILDEGARD VON BINGEN (chapter IV) it is advised for ailments of the head. Also might not *Alficanus* be the *Alfita (Polenta, farina)* of the *Gloss. Med.* of SIMON JANUEN " Alfita, ex recentibus ordeis torrefactis commensurate optimum alfiton fit. Alfiton Arabes savich vocant," DU CANGE, " *Alfita* "? The savich of the Arabs is explained by P. GUIGES in *Les noms arabes dans Sérapion*, Paris, 1905. Could *Interrusca* and *terrusca* both be a corruption of the words *Inter* meaning middle and *Rusca* which according to DU CANGE is " Apium cubile voce Rusca revera intelligendum esse " etc.?

For the other drugs for which the editor has given a number of possible identifications, further information can be gained from FISCHER *Mittelalterliche Pflanzenkunde*, FLÜCKIGER and HANBURY's *Parmacographia*, IBN SĪNĀ's *Qānūn*, *Gart der Gesundheit*, and many other sources.

For the compound drugs for which ultimate sources were not determined, a number may be found in IBN SĪNĀ, cf. *Electuarium diacyminum*, p. 993 ; *Throchisci de rosis, nominati diarhodon*, p. 1009 ; *Zinziber conditum*, p. 1008 ; *Tryphera maior*, p. 999 ; etc., and in other medieval *Antidotaria*.

In a book otherwise so well edited and printed, it is to be regretted that there are a number of typographical errors, for example, p. 37 ecommon, p. 39 wifh, p. 41 greaty, p. 151 leeehdom, and so on.

Harvard Library 189 MARY CATHERINE WELBORN.
Cambridge, Mass.

Barnette Miller. — *Beyond the Sublime Porte.* The Grand Seraglio of Stambul. With an Introduction by HALIDÉ EDIB. XXV+281 p., 69 plans and illustrations. Yale University Press.

It may be said with safety that this book is unique. There is not in any western language any book which covers its subject with anything like the same detail and exactitude, and even in Turkish there is nothing which brings together the same mass of information. The material included in it is enormous and would be oppressive to any but the born topographer who can carry elaborate plans instinctively in his head, if it were not for the vision which shows through it all of the growth, flowering and slow decay of a unique and majestic scheme of human existence. As HALIDÉ EDIB finely and truly says in her preface, " The gradual seclusion of majesty and of women, the eunuch and guard system with all its implied social intricacies, pomp and richness, the sense of relentless power and authority—a combination of Byzantine, Persian and Roman ideas of power—are all there. One sees in passing the simple and democratic Turkish ruler of the Brusa period being transformed into the Great Emperor of the Near East, the successor of the Caesars." Nowhere else in human history, except perhaps in the Forbidden City of Peking, do we know of any other such complex of ideas and institutions, and of buildings expressing both of these, as here.

Professor MILLER traces in detail the construction of the Seraglio on a plan steadily held from MUHAMMAD II in the latter part of the fifteenth century until the end. This discovery of a persistent plan is one of her specific contributions to the subject. But her book is not simply topographical. Much Turkish history is brought out in a new, fresh, way and chapters deal with the intricate social life of the enormous household which lived in those buildings, extending from the organization of the government offices to the domestic economy of the kitchen and the scrupulous isolation of the harem. Turkish life, of the higher classes at least, becomes thus very vivid. Again, in the present political position of the peoples of Islam, chapter IV, on the Pavilion of the Holy Mantle, is of peculiar interest. It is in that pavilion that the personal relics of the Prophet are preserved and are surrounded with an elaborate ceremonial of perpetual recital of the Koran which is still maintained. This chapter and the notes upon it, as to the history of the relics and their relation to the Caliphate, should be studied by all interested in the constitutional theory of Islam.

Again, the third chapter on the Palace School is of quite peculiar interest as it brings out clearly the secret of the long prosperity of the Turkish empire and also the glaring contrast between the ideas fundamental to that prosperity and all our conceptions of a triumphant, self-

ruling democracy. And the contrast goes further and is also between this idea of the Turkish state and the idea of the self-governing democracy of Islam, worked out, in theory at least, by the Muslim canon lawyers. How the Ulama of Constantinople managed to reconcile that conception of the People of MUHAMMAD ruling itself by divine right, which their faith compelled them to hold and teach, with the dynastic absolutism of the House of Utman, administering its will through a slave army and slave civil service, is still a subject to be treated by the student of constitutional law. It is an utter paradox, as strong a paradox for the Muslim peoples as for us of the modern western world. But the paradox is there and yet, without question, the Turkish system, which produced it, through centuries pragmatically " worked." It worked because under it there was put a great plan of education for those slave functionaries of the state. That plan is sketched in Professor MILLER's third chapter and we are promised a second volume in which that sketch will be worked out in detail. That the plan was so unique as Professor MILLER suggests may be doubted, for administration through slave officials is old in the East and in Islam. But it may well be that the Turkish form was by far the most complete and successful. Its long endurance speaks for that. But the Abbasids must have had something more or less of the same kind and also the Mamluk dynasties of Egypt. In these cases, however, the scheme probably owed more to the normal training through which the Ulama were put, and the unique and more secular imprint in Constantinople may well have been derived from Greek influence. To our modern philosophers, meditating on the Republic and Laws of PLATO, it may come with an odd jar that the nearest realization of PLATO's dreams of an ideal state was under the rule of the Grand Turk. It takes autocracy to give philosophy a chance. Certainly for us, with all our conceptions from education to government in the melting-pot, the Palace School of the Ottomans is worth considering. It is to be hoped, then, that Professor MILLER's second volume will not be long in appearing. Its subject is of today.

D. B. MACDONALD.

A. Waley. — *Notes on Chinese Alchemy* (Supplementary to JOHNSON's *A Study of Chinese Alchemy*). *Bulletin of the School of Oriental Studies, London Institution*, Vol. VI, Part 1, 1930.

This paper contains material supplementary to JOHNSON's *Study of Chinese Alchemy* (reviewed in *Isis*, 12, 330-332) and material tacitly at variance with JOHNSON's conclusions and in criticism of them, but it makes no mention of JOHNSON's book beyond the mention which appears in its title.

WALEY thinks that the earliest reference to alchemy in any language, the passage which occurs in the history of SSU-MA CH'IEN, Book 28, and in the *Han Shu*, Chapter 25, in which it is stated that the magician SHAO-CHÜN taught the Han Emperor, WU TI, the art of making gold from cinnabar, etc., is a later addition to the History of SSU-MA CH'IEN and really dates from the first century A.D. He quotes the story of CH'ENG WEI's alchemical experiments from the *Hsin Lun* of HUAN T'AN (died about 25 A.D.) and concludes that it rightfully belongs to the first century. He believes that the *Ts'an T'ung Ch'i* was written by a pseudonymous WEI PO-YANG in the second century. KO HUNG regarded WEI PO-YANG as a sage of remote and shadowy times. « In the list of Taoist books at the end of *Pao P'u Tzŭ* (recording over 80 volumes, the first bibliography of its kind) KO HUNG mentions a *Nei Ching* or *Inner Book* of WEI PO-YANG, but not the *Ts'an T'ung Ch'i*. Nor is the latter ever mentioned throughout the book. It seems likely that the *Shen Hsien Chuan*, which gives an account of WEI PO-YANG and mentions him as the author of the *Ts'an T'ung Ch'i*, though a work of the fourth century, was merely an anonymous series of Taoist biographies, which some mistaken person labelled as KO HUNG's *Shen Hsien Chuan* and divided into ten chapters. »

Concerning the *Ts'an T'ung Ch'i*, WALEY says further — « Is it not possible that the work was originally an exposition of the *Book of Changes* and that some time after *Pao P'u Tzŭ* and before the *Shen Hsien Chuan* (say in the latter part of the fourth century) someone doctored the text so as to make it serve as a work on alchemy? The actual number of insertions necessary for this purpose would have been very small. The first third of the work is purely cosmological. References to the firing of metal in a furnace are not necessarily concerned with alchemy; the principle that ' fire conquers metal ' belongs to the speculations of the cosmologists, as does the identification of the five metals with the five planets. The only one of the 90 sections which is clearly and indubitably concerned with the Elixir is the thirty-second.—Apart from this paragraph, the number of passages that are incapable of interpretation except as disquisitions on alchemy is very small. » The present reviewer has at hand an English translation by LU-CH'IANG WU of the whole of the *Ts'an T'ung Ch'i* and cannot agree with this opinion. It seems to him that the various parts of the *Ts'an T'ung Ch'i* clarify one another in a way which can not easily be shown by extracts and that the whole constitutes a coherent and unified treatise on alchemy which is certainly as clear, for example, as the *Speculum Alchemiae* which is ascribed to ROGER BACON. The *Ts'an T'ung Ch'i* even describes the process, so familiar in mediaeval writings on alchemy, in which the ingredients

are heated together in a tightly-closed vessel with a fire which is gentle at first and is increased as time goes on.

WALEY describes the line of transmission by which KO HUNG obtained his knowledge of alchemy, from a certain CHENG YIN who learned from KO HSÜAN, KO HUNG's great-uncle, who himself learned from TSO T'ZÛ (about 220 A.D.) who had been instructed by a deity.

« The fourth book of the esoteric chapters of *Pao P'u Tzŭ* treats of two forms of the elixir, the ' Golden Cinnabar ' or Philosopher's Stone, and Gold Juice. The first method involves a variety of ingredients which may be procurable in times of peace; but when war interrupts communications, this method becomes impossible. The Gold Juice method is much simpler; but it is very expensive. KO HUNG reckons that it costs 50,000 cash to make an Immortal in this manner.

« From these two practices KO HUNG sharply distinguishes the art of *Huang Po* (yellow and white), i.e. the art of transmuting the baser metals into gold and silver, without any ulterior notion of attaining to better health, longevity, immortality, or the like. The two branches of alchemy, though apparently so rigidly divided by KO HUNG, do not appear to belong to a different line of transmission. For he tells us that his teacher CHENG YIN practiced *Huang Po* with TSO T'ZÛ, and that they never had a single case of failure. By this method not only lead but also iron was changed into silver. »

KO HUNG's attitude toward alchemy « is always that of a solidly educated layman examining claims which a narrow-minded orthodoxy has dismissed with contempt. He condemns those who are unwilling to take seriously either ' books that do not proceed from the school of the Duke of Chou or facts that CONFUCIUS has not tested. ' »

T'AO HUNG-CHING (451 or 452 to 536) was a prolific writer on Taoist subjects and was regarded in later times as an important alchemist but his existing writings make only fleeting allusions to alchemy. The Wizard SSU-MA CHĒNG-CHĒN, who died at an advanced age about 720, had a great reputation as an alchemist, but his surviving works deal with other subjects. In the works of P'ĒNG HSIAO (late ninth and early tenth century), who wrote a commentary on the *Ts'an T'ung Ch'i*, « we again meet with the distinction (already made by HUI-SSÛ) between *exoteric* alchemy, which uses as its ingredients the tangible substances mercury, lead, cinnabar, and so on, and *esoteric* alchemy which uses as its ingredients the ' souls ' of these substances. These ' souls ', called the ' true ' or ' purified ' mercury, etc., are in the same relation to common metals as is the Taoist Illuminate to ordinary people. Presently a fresh step is made. These transcendental metals are identified with various parts of the human body, and alchemy comes to mean in China not

an experimentation with chemicals, blow-pipes, furnace, etc. (though these, of course, survived in the popular alchemy of itinerant quacks), but a system of mental and physical re-education. This process is complete in the *Treatise on the Dragon and Tiger* (Lead and Mercury) of SU TUNG-P'O, written *c.* 1100. »

After discussing the interaction of Taoist alchemy with Buddhistic ideas, and the antiquity of alchemy in China, in India, and in the Greek world, WALEY concludes as follows.—« Further examination of Arabic alchemy will show, I am convinced, that it contains a vast element which it owes to China rather than to the Greek world. In particular the idea of the ' philosopher's stone ' as an elixir of life is a contribution of the Chinese. The second period of their influence was the time of the Mongol conquest. We have seen how the Chinese alchemist CH'ANG-CH'UN visited Samarkand in 1221-1222. Here he came in contact with the leaders of the Muhammedan community, and we cannot doubt that the teachings of a holy man, summoned from so great a distance by the Khan himself, made a considerable impression on the mysticism of Eastern Persia, just as the artists summoned to Persia by the Mongol Khans had a lasting influence on the pictorial art of the country. How soon this influence is reflected in Arabic literature I do not know. But it is manifest (travelling, no doubt, via the Arabs) in much of the mystic literature of our own Renaissance, in which the quest of the alchemist seems to have become purely subjective and internal. »

TENNEY L. DAVIS.

Émile Picard. — *Éloges et discours académiques.* VIII+400 p. Paris, GAUTHIER-VILLARS, 1931 (50 frs.).

Cette collection fait suite aux « Discours et mélanges » et aux « Mélanges de mathématiques et de physique » publiés en 1922 et 1924 par le même éditeur. L'intérêt historique et autobiographique de ces trois ouvrages est considérable. Bien entendu les historiens de la science ne s'attendent pas à une érudition impeccable de la part d'un auteur qui est avant tout et surtout un mathématicien, — l'un des plus grands de notre temps; — ils ne songent pas à consulter les discours de M. PICARD pour déterminer des points d'histoire, mais ils ne peuvent rester indifférents aux commentaires d'un savant illustre. Le présent ouvrage contient le discours de réception de l'auteur à l'Académie française (11 février 1926) où il est le digne successeur de PASTEUR, JOSEPH BERTRAND, et CHARLES DE FREYCINET, et de plus des essais sur PASCAL, MARC SÉGUIN, ABRAHAM BRÉGUET, JULES TANNERY, NEWTON et LAPLACE, le Bureau international des Poids et Mesures, JEAN-BAPTISTE BIOT, l'Institut, HENRI POINCARÉ, HUYGENS, et l'histoire des sciences et des théories physiques. Espérons

de tout cœur que cette troisième série de discours sera suivie de plusieurs autres. G. S.

Émile Meyerson. — *Du cheminement de la pensée.* Bibliothèque de philosophie contemporaine. 3 vol. in-8°. XXVII+294+422+320 p. Paris, FELIX ALCAN, 1931. (Fr. 130).

La doctrine de M. MEYERSON est bien connue des lecteurs d'*Isis* qui savent que ce profond penseur s'est efforcé d'établir dans une série d'ouvrages à la fois brillants et solides, que l'essence du raisonnement scientifique consiste à identifier, à réduire par là au plus simple, et à la limite à l'unité, la diversité infinie du donné sensible qui, par sa richesse extraordinaire et par ses modifications continues, résiste plus ou moins à l'effort de notre intellect. (Voir pour les compte rendus, *De l'explication dans les sciences*, de *La déduction relativiste*, et d'*Identité et réalité*, *Isis*, 4, 382-85; 7, 517-20; 9, 470-72).

Nous ne pouvons ici insister sur ces conclusions qu'avec l'auteur nous considérons comme acquises et nous allons dire quelques mots de l'ouvrage considérable par lequel M. MEYERSON a voulu couronner son œuvre en la poursuivant à la fois en superficie et en profondeur : en superficie, car la doctrine de M. MEYERSON, qui précédemment ne s'appliquait qu'à la pensée scientifique, s'étend désormais à la pensée commune, sans qu'il soit possible de déceler une coupure entre le sens commun vulgaire et la théorie la plus élaborée qui a pris naissance en se dégageant et en prolongeant le sens commun. En profondeur, car M. MEYERSON s'est appliqué à démonter entièrement le mécanisme de la pensée afin d'en saisir la marche ou, comme il dit, le cheminement.

Par son ampleur même, l'ouvrage de M. MEYERSON est en dehors des recherches directes concernant l'histoire des sciences; il nous sera donc impossible d'analyser entièrement ou de discuter même superficiellement ses affirmations essentielles qui, même là où elles n'entraînent pas la conviction du chercheur, font du moins travailler son esprit en ouvrant des perspectives nouvelles à sa méditation; mais cependant, il sera utile à l'historien des sciences de bien connaître l'œuvre de M. MEYERSON; car celle-ci espère, en développant d'une manière qui ne craint pas le paradoxe, les principes permanents de la raison qui soutiennent constamment la science en perpétuel devenir, jeter une lumière vive sur la pensée scientifique qui, en tous temps et en tous lieux, procède suivant le même schéma. D'autre part, ce passé de la science est utilisé par l'auteur à la fois pour construire et pour illustrer sa puissante doctrine; nous nous excusons de ne pouvoir dans les limites de ce court article donner une idée de cet ouvrage qui est véritablement un monument. L'étendue du champ recouvert par l'auteur qui, en tentant de

mettre à nu le ressort profond de notre intelligence, est obligé d'examiner les circonstances multiples où celle-ci s'efforce de comprendre et d'innover, ne peut se contempler d'un coup d'œil. On trahirait sa pensée d'une richesse et d'une intensité étonnante si on voulait la faire rentrer tout entière dans « le lit de Procuste » d'un compte-rendu. Nous avons cherché à exciter la curiosité du lecteur plutôt qu'à la satisfaire.

L'érudition prodigieuse de M. MEYERSON lui permet de faire comparaître devant lui et plaider leur propre cause les philosophes et les savants qui depuis l'époque d'ANTISTHÈNE et de PLATON jusqu'à celle de MM. WHITEHEAD et RUSSELL ont discuté, voire même disputé, sur le fondement et la portée de notre logique, de même qu'elle l'autorise à recueillir les témoignages des physiciens contemporains qui, par leurs efforts prolongés, ont modifié la face de la science en créant les théories de la *Relativité* et des *Quanta*. Elle lui permet de comparer les raisonnements de ces physiciens et les schémas par lesquels M. LÉVY-BRUHL a dépeint la marche de la pensée des primitifs et de conclure à leur identité; elle lui permet de rapprocher les efforts apparemment si dissemblables de la pensée mathématique et de la pensée purement conceptuelle ou extra-mathématique qui semblent si dissemblables l'une de l'autre; sans doute les citations qui se pressent en foule à l'appel de l'auteur ne représentent-elles qu'un aspect de l'œuvre des philosophes dont il invoque le témoignage. Mais, malgré cette réserve que M. MEYERSON a tenu lui-même à exprimer à diverses reprises, que de choses à apprendre dans son dernier ouvrage; que de faits brillamment relatés, soit dans le texte même de l'ouvrage, soit dans le volume de « Notes » qui est justement consacré à poursuivre les investigations de l'auteur sur des sujets qu'il n'a effleurés qu'en passant, indépendamment de l'objet même de son livre. Mais à quoi bon s'étendre davantage sur ce que M. MEYERSON dit *du cheminement de la pensée*. Il faut lire soi-même son œuvre pour en sentir toute la richesse et la force suggestive, alors même que l'on ne peut agréer toutes les conclusions de l'auteur.

L'ouvrage se termine par un excellent index alphabétique qui permet de retrouver rapidement les passages recherchés.

Paris. HÉLÈNE METZGER.

Henry Chester Tracy.—*American Naturists.* VIII+282 p. E. P. DUTTON & Co., New York, 1931. $ 3.90.

The author includes nineteen men and but two women in his list of naturists, explaining this discrepancy in representation by the opinion that women are more interested in useful ends and men more sentimental. The names presented fall into two periods. The early Americans include the two BARTRAMS, JOHN and WILLIAM, both botanists, and the ornitholo-

gists, ALEXANDER WILSON and J. J. AUDUBON. In the second group, the moderns, are listed H. D. THOREAU, JOHN BURROUGHS, JOHN MUIR, OLIVE THORNE MILLER, MAURICE THOMPSON, W. T. HORNADAY, THEODORE ROOSEVELT, CARL AKELEY, R. C. CHAPMAN, E. H. FORBUSH, W. L. DAWSON, F. M. CHAPMAN, W. P. EATON, L. H. BAILEY, WILLIAM BEEBE, E. THOMPSON SETON, and MARY AUSTIN.

Naturists are those seeking to reveal in literature the aesthetic values of nature. Naturalists may be collectors and are wont to be classifiers. Hence LOUIS AGASSIZ and ASA GRAY find no place in this work, though no Americans have contributed more to acquaintanceship and appreciation of nature than these early teachers of science.

The inclusion of names such as those of several well known ornithologists and mammalogists in this list shows clearly how artificial is the segregation proposed by the author. The aesthetic element is rather deeply involved in the scientific mind and is seemingly basic in scientific discovery, as POINCARÉ has shown in his classic essay on « Mathematical Discovery. » A certain unity of aim, rather than of accomplishment, links the chosen names. Perhaps it is, as the author suggests, a quality of art, which often, alas, even in these chosen few, descends to mere artistry. As scientists, much credit for keen observation and for not a little sound criticism is due these naturists. The author's sympathetic and often critical presentation of their widely divergent contributions is a real service both for present day American interpreters of nature, aesthetic and more mathematical alike, and for foreign readers seeking a resumé of the best in the first century of American natural history.

CHARLES A. KOFOID.

A. Piney.—*Recent advances in microscopy*. Biological applications. Edited by A. PINEY. Medicine, by A. PINEY; The living eye, by BASIL GRAVES; Zoology, by E. W. MACBRIDE and R. R. HEWER; and Botany, by E. C. BARTON-WRIGHT. VIII+260 p., 83 figs. in text. Philadelphia, P. BLAKISTON's Son & Co., 1931 ($ 3.50).

This volume in the " Recent Advances Series " deals with the results of current microscopical research in diverse fields with different types of instruments. The chapter on the microscopy of the living eye explains the application of the GULLSTRAND slit-lamp and the CZAPSKI binocular microscope to the study in life of the various structures of the human eye from the cornea to the retina and notes its use in the detection of the early stages of ocular neoplasms. It is a full summary of important advances since the publication of VOGT's " Atlas " in 1921. The other three chapters form more of a unit, as they are all concerned largely with histological and especially cytological advances in the methods of ex-

ploration and knowledge of the finer structures in plant and animal cells.

In the medical section Dr. PINEY reviews (without bibliography) the subject of keratinization ; the relations of mitochondria and GOLGI bodies in zymogen- and mucin-secreting cells of the stomach ; the argentaffin cells of the intestine which have been held to have an endocrine function ; the cellular elements of the blood ; and the endocrine glands. Professor E. W. MACBRIDE and Mr. H. R. HEWER write a very full survey of the trends in cytology in recent years, including the vacuome theory ; the GOLGI apparatus in animal and plant cells, its varying structure, and its relation to the secretory function ; and the morphology and function of the mitochondria in Protozoa and is germ cells. The cytology of the nucleus and nucleolus, translocation induced by X-rays, deletion, and fragmentation of chromosomes, nucleolar extrusions in relation to yolk formation and to the GOLGI bodies are reviewed. A very valuable section is a review of the entire cytology of both nucleus and cytoplasm during spermatogenesis, oogenesis, and yolk formation. There is also a review of the evidence for the neuromotor system of the Protozoa. A selected bibliography of the subject is included.

Mr. BARTON-WRIGHT summarizes the advances in botanical cytology, including the GOLGI apparatus, mitochondria, and the vacuome. He also treats chromosome structure and surveys the recently developed evidence that the nucleolus contributes to the chromatin of the developing nuclear figure. Protomitosis is outlined in the Plasmodiophorales, in the Cyanophyceae, and in the Bacteria. The first-named group is in reality quite out of place in this association. They are animals rather than plants and are, as their nuclear figures quite clearly indicate, not unlike those of many Sarcodina. The kinetics of cell-division and the meiotic process, especially in hybrid Oenothera, are reviewed. Sex chromosomes, polyploidy, and sterility are discussed, and a brief account is given of CHAMBERS' results in microdissection, of the structure and composition of the cell wall, and of lignified tissues. The discoveries of the last quarter of a century reviewed in this book constitute the foundations of our critical knowledge of cell structures and functions which underlie modern physiology and genetics. The book, therefore, has permanent historical value as a critical synthesis of results in a basic field of biology in what may ultimately prove to have been one of the most brilliant periods of biological discovery.

CHARLES A. KOFOID.

E. O. Essig. —*A History of Entomology*. x+1029 p., 263 figs. in text. The MACMILLAN Company, New York. 1931. $ 10.00.

The economic note prevails throughout this history of entomology

from the preface to the index. In fact the chief object of the volume is frankly stated to be to trace the progress of economic entomology in meeting the needs of agriculture and horticulture. These forms of human culture had a phenomenal growth, both in extent and rapidity of development, in the Central and Western United States in the last century due to the growth of new agencies of transportation, the expansion of irrigation, the introduction of new plants from many different countries, and with them their old insect enemies and their exposure to new ones. These gigantic biological experiments attained vast proportions in the grazing, cereal, vegetable, and fruit growing divisions of agriculture in the fertile valleys and foothills of California. This book portrays man's battle with his insect enemies on the Western front over a period of nearly a century. The contest reached its height in this region and the strategy developed here, notably in spraying, fumigation, the introduction of foreign parasites and insect enemies of insect pests, has been widely followed throughout the world.

The book is none the less valuable and all the more interesting because its actors and stage are largely local, i.e., Californian. The author dips first into the tar pits at Rancho La Brea for the prehistoric insects of the Pleistocene and then turns to the food habits of native Indians in California. They were a degenerate folk with no agriculture and little skill in hunting, and hence depended on the natural products of plain and forest. Insects entered largely into their diet, grasshoppers, larvae of borers, puparia of *Ephydra*, a fly whose larva feeds in the saline lakes, especially in Mono Lake, where at certain seasons of the year their puparia are washed up in windrows, gathered, dried, and stored as food by the Indians. The full grown caterpillars of *Coloradia pandora*, a pine moth, are smoked out of the foliage of the pine trees, cooked and dried.

The fourth chapter deals with the history of the organization of entomological research and instruction in the California Academy of Sciences, the University of California, and in other educational centers in the state. There are also histories of local and Pacific Coast natural history and entomological societies and clubs.

The fifth chapter is concerned with the more important mites and insects affecting orchards and vineyards in California, and other insects of economic significance. The history is related of the various efforts to establish the silkworm industry, thus far baffled by disease, foreign competition, and economic conditions. Far more successful has been the expansion of bee farming introduced from New York in 1853 and not by the Russian colony at Fort Ross in 1813 from Kazan as sometimes erroneously maintained.

The chapter on the biological control of insect pests relates the history of the growth of the practice of using predacious and parasitic insects to destroy the insect enemies of crops and fruits. There was much discussion of such procedures in California from 1872 on, but the first actual importation of parasites of the cottony cushion scale insect was made in 1888. In the same year Mr. ALBERT KOEBELE sailed for Australia in search of such parasites and predators and thus initiated the practice so widely developed by himself and others in later years. The first shipment of the predatory *Vedalia* beetles was received from Australia in 1888. In 1889 the warning of the danger of importing destructive parasites of the beneficial introduced insects was first given by W. D. COQUILLET. The success of KOEBELE's importations, especially of the Mealy Bug Destroyer, *Cryptolaemus*, in the biological control of insect pests was epochal in the history of applied entomology and easily ranks among the outstanding accomplishments in that field in the last century. This chapter is a valuable account of the many species of parasitic and predatory insects introduced into California for economic reasons with the record of their successes and failures. The work of KOEBELE, COMPERE, VIERECK, VOSLER, CLAUSEN, and HENDERSON as foreign collectors is reviewed and the increase of State Insectaries for the culture and local dissemination of beneficial insects is well illustrated.

The historical account of the scientific elaboration and commercial development of insecticides is followed by a chapter on entomological legislation on matters of inspection, quarantine, insecticides, mosquito abatement, and other sanitary matters.

The chapter of greatest historical content is that dealing with the biographies of 114 entomologists. This list includes the fathers of entomology in the United States, the pioneer collectors, teachers, and investigators of the West, and a few of the founders of entomology of international fame, such as LINNAEUS, DE GEER, BURMEISTER, and others. Each biography includes a summary of the life of the scientist concerned, a statement of his important studies and discoveries, a list of the insects named by him and after him, and a list of his important works. A full hundred portraits adorn these pages. A chronological table of 142 pages giving the dates of the births and deaths of many entomologists and also of other noted persons, is supplemented by a column of important events in the history of science, dates of important books, and of scientific discoveries.

This history of entomology, though local in its sources, and mainly concerned with the economic aspects of the science as related to agriculture, is nevertheless a mine of scientific entomological information, assembled with great industry and meticulous care. Many an elusive

fact has been ferreted out, or error run to earth, in the preparation of its pages. It will always remain a source book of economic entomology covering the period of its origin and successful elaboration. The author writes from the background of intimate personal knowledge of most of the men concerned in its development and of active contact with its processes, its problems, its failures, and its successes. For these reasons the book is a vital one with lasting values.

CHARLES A. KOFOID.

Lucien Lévy-Bruhl. — *Le surnaturel et la nature dans la mentalité primitive*. Bibliothèque de philosophie contemporaine. XL+526 p. Paris. FELIX ALCAN. 1931 (60 Frs.) *La mentalité primitive*. Une Herbert Spencer lecture. Brochure 27 p. Oxford, at the Clarendon Press.

Dans de nombreux ouvrages que nous avons analysés ici même (1), Mr. LÉVY-BRUHL s'est appliqué à déterminer quels sont les caractères distinctifs de la mentalité des populations appelées habituellement sauvages ou primitives; l'on sait que cette mentalité qui avait semblé parfois incompréhensible, inouïe aux premiers observateurs, lui a paru s'illuminer et devenir presque transparente quand il a renoncé à la pénétrer à l'aide des schémas que les psychologues ont tracés pour rendre compte de notre caractère et de notre pensée; l'on se souvient encore que dans ses premiers livres, Mr. LÉVY-BRUHL a tenté de préciser théoriquement l'orientation spontanée de cette intelligence chargée d'émotivité mystique, dénuée de sens critique, indifférente bien souvent à la criante contradiction, et constamment dans l'inquiétude. On se rappelle enfin que la pensée primitive qui n'est encore que « prélogique » est régie par la *loi de participation*, très difficile à énoncer abstraitement et qui nous semble fort étrange; car elle permet d'affirmer l'identité simultanément partielle et complète entre évènements et choses apparement fort différents qui seraient cependant les mêmes.

L'ouvrage que Mr. LÉVY-BRUHL vient de publier est destiné à mettre le lecteur directement en contact avec les réactions psychiques des sauvages et cela sans aucun intermédiaire dialectique ou théorique; évitant tout appareil scientifique apparent, mais en utilisant constamment les résultats déjà acquis, l'auteur pénètre la mentalité primitive « en acte »; il la voit dans les différentes circonstances de la vie individuelle et sociale, réagir du mieux qu'elle peut pour se mettre à l'abri des terreurs paniques, des périls constamment menaçants, en même temps qu'elle fait effort pour capter d'une manière ou d'une autre les innombrables puissances

(1) *Isis*, 5, 467; 9, 482; 12, 345-47.

invisibles dont dépend aussi bien le malheur redouté, que le bonheur ardemment souhaité.

Le lecteur, en ouvrant le livre, est très étonné de cette fantasmagorie si obsédante et si vivante; quoi, demande-t-il, se peut-il, que le naturel et le surnaturel interfèrent continuellement dans l'esprit des populations sauvages? Se peut-il qu'elles se contentent de représentations aussi intenses que vagues? Se peut-il qu'elles soient si fort attachées à un ensemble de croyances qui paraissent aussi indéterminées que confuses quand on cherche à les préciser, que violemment dominatrices quant aux passions qu'elles déchaînent, et aux réactions émotives qu'elles provoquent? C'est là qu'entre en jeu ce que Mr. LÉVY-BRUHL appelle la *catégorie affective du surnaturel;* les « puissances invisibles », les « forces » diverses dont le primitif se sent entouré, qu'il craint immensément ou dont il veut s'attirer les bonnes grâces, ne sont pas pour lui des réalités conceptuelles et définissables, mais des agents dont il n'a qu'une notion émotionnelle; l'émotion, fait remarquer l'auteur, que WILLIAM JAMES aurait certainement approuvé, peut donc autant que l'idée créer un élément de généralité. Mais si il en est ainsi, la portée de l'étude de Mr. LÉVY-BRUHL dépasse infiniment son objet propre, car nous sommes amenés à nous demander si la division des « facultés de l'âme » en sensibilité, intelligence et volonté, que les philosophes avaient bien souvent dénoncée, mais qui reste vivante dans l'enseignement et dans notre esprit, n'est pas définitivement périmée, s'il ne faudrait pas reprendre sur des bases absolument nouvelles l'analyse de notre mentalité à nous.

N'insistons pas sur ce point qui est en dehors de nos préoccupations immédiates d'historiens des sciences; notons, au milieu de bien d'autres, quelques observations susceptibles de jeter une vive lueur sur la formation des hypothèses spontanées qui ont servi de point de départ à la réflexion scientifique, même si celle-ci a dû les préciser, les modifier, ou les nier avant de poursuivre son effort; remarquons tout d'abord que pour le primitif qui ignore aussi bien la physiologie que la psychologie, la nature entière est animée par des puissances vitales semblables à celles que nous éprouvons en nous même; la notion de contagion, d'origine apparemment expérimentale, et qui a été justifiée par la théorie des miasmes avant la découverte des microbes, existe, ambiguë sans doute, mais toute puissante chez les sauvages; pour eux, le cadavre communique la mort, le souillé la souillure, le malheureux le malheur, et le bienheureux le bonheur; et si il y a des exceptions, s'il arrive que la contagion soit « élective », si le lépreux n'est pas un danger pour celui qui a pour lui une affection véritable, c'est en vertu d'une force interne capable de discernement mais dont le malade n'a aucune conscience directe. ... Pareillement l'immunité que la médecine sait aujourd'hui provoquer et utiliser est

déjà chez les primitifs l'objet d'une technique mystique qui explique le rôle tout puissant de la vengeance et de la loi du talion... Remarquons encore que pour l'ignorance spontanée qui s'ignore en tant que telle, la moindre ressemblance entre deux choses, quelles qu'elles soient, dévoile en elles une communauté de nature et de puissances; si l'ocre rouge est rouge comme le sang, il en a la vertu bienfaisante, et il guérit les Australiens fatigués ou malades... Nous livrons sans commentaires ces quelques observations aux réflexions des historiens des sciences en leur recommandant de lire l'ouvrage de Mr. LÉVY-BRUHL même.

On a souvent cru que Mr. LÉVY-BRUHL avait tracé une barrière infranchissable entre la mentalité primitive et la mentalité qui se dit « civilisée »; l'étrangeté de la doctrine que l'auteur a mise avec art dans le plus grand relief a donné lieu à un malentendu qu'il a lui-même dissipé dans une conférence lue à Oxford le 29 mai 1931. Il a déclaré avec force qu'entre les deux modes de pensée, il n'y avait aucun fossé. « Si, ajoute-t-il au contraire, une fois admise l'identité de la structure fondamentale de l'esprit chez tous les hommes, nous portons notre effort d'investigation sur les caractères propres de la mentalité primitive, nous avons quelque chance, soit de mettre en lumière des faits restés dans l'ombre, soit des faits connus sans doute mais jusqu'à présent peu ou mal expliqués. »

Si maintenant nous demandons comment l'esprit humain a pu tenter de se libérer de cette fantasmagorie obsédante qui conduit l'*âme primitive* à la magie et à la superstition, non au véritable savoir, il nous sera sans doute répondu que c'est par l'instauration du jugement critique, qui demande à nos croyances, précédemment irraisonnées, quelles sont leurs marques de vérité, c'est en refusant de céder à toutes les impulsions de son âme auxquelles il était précédemment livré sans défense aucune, que l'homme a entrevu la voie qui devait le mener à la science. S'il en est ainsi, comme semble par exemple le démontrer la révolution cartésienne succédant à l'exubérance de la Renaissance pour créer la physique moderne — ce jugement qui se retient, ce doute méthodique qui attend jouent d'abord un rôle inhibiteur; par là, se trouve déjà imposée à notre intelligence une discipline qui l'oblige à réfléchir sur elle-même et sur ses affirmations spontanées. Les impulsions primitives sont canalisées, endiguées; loin d'être nos maîtresses, elles sont les inspiratrices ou les servantes de l'esprit scientifique; mais elles ne sont pas tuées et elles continuent à travailler sourdement en nous.

Mais, pourra-t-on demander encore, le jugement critique n'a-t-il qu'un rôle inhibiteur, ou est-il capable d'instaurer une nouvelle forme de la pensée scientifique? Quel a été son rôle en particulier dans le développement des mathématiques et de la physique? En d'autres termes, par quels traits les chercheurs d'autrefois et d'aujourd'hui se distinguent-

ils des *magiciens* et des *medicine men* sauvages? Une réponse précise à ce problème, que l'œuvre de Mr. LÉVY-BRUHL nous oblige à nous poser à nous-même, ne pourra être obtenue que par les historiens des sciences qui contribueront par leurs recherches à la connaissance de l'esprit humain

Paris. HÉLÈNE METZGER.

Dessoir, Max. — *Vom Jenseits der Seele.* Die Geheimwissenschaften in kritischer Beleuchtung. 6., neu bearbeitete Auflage. XIV+562 S., 4 Tafeln. Stuttgart, Verlag FERDINAND ENKE, 1931. (Brosch. M. 16.-, geb. M. 18.-)

Der bekannte Berliner Psychologe und Philosoph MAX DESSOIR verfolgt seit 45 Jahren aufmerksam das Grenzgebiet des sog. Okkultismus und kann als einer der besten kritischen Kenner desselben gelten. Um so erfreulicher ist es, dass bei der Fülle minderwertigen Schrifttums, das alljährlich auf diesem Gebiete auf den Büchermarkt gelangt, sein grosses, 1917 erstmals erschienenes, vielfach auf eigenen Erfahrungen fussendes Werk nunmehr in neuer Bearbeitung herausgekommen ist. Ausser einer einführenden Uebersicht über das Gesamtgebiet gliedert sich das Buch in vier Hauptabschnitte: Parapsychologie, Paraphysik, Geheimwissenschaft und magischer Idealismus. Im ersteren werden Traum und Hypnose, Telepathie und Hellsehen, und der seelische Automatismus behandelt. Der zweite ist den sog. physikalischen Medien gewidmet, deren Tricks erläutert werden, wobei auch das in diesem Zusammenhang wichtige Kapitel der Psychologie der Taschenspielkunst — ein den Okkultisten meist fremdes Gebiet — zu seinem Recht kommt. In dem Abschnitt über Geheimwissenschaft werden kabbalistische Mystik, Christian Science und die Anthroposophie eingehend zergliedert und in ihren Schwächen aufgezeigt. Den stärksten historischen Einschlag weist der letzte Abschnitt auf. Er ist deshalb wichtig, weil er auf die weltanschaulichen Grundlagen eingeht, die noch den heutigen geheimwissenschaftlichen Systemen zugrunde liegen, deren Wurzeln aber weit ins Altertum, in uralten Volksaberglauben und in mittelalterliche Denkformen zurückreichen.

Graf CARL V. KLINCKOWSTROEM.

George Matthew Dutcher, Henry Robinson Shipman, Sidney Bradshaw Fay, Augustus Hunt Shearer, and **William Henry Allison** (editors). — *A Guide to Historical Literature.* XXVIII+1222 pp. New York: The MACMILLAN Company; 1931. $ 10.50.

This compendious work of reference covering some 12,000 titles, carefully selected from a vast literature and critically though concisely appraised by over 350 scholarly contributors in the field of the social

studies, organized and edited by a special committee of the American Historical Association and a group of some twenty-five other American historians who acted as section editors, constitutes the most ambitious and important handbook for American students of historical literature thus far compiled. Though world-wide and timelong in scope, its aim is deliberately limited by the editors " to furnish a carefully chosen list of available books in each of the several fields to the English reading audience, primarily to libraries, teachers, and graduate students." The selection of material has been chiefly from works written in English or from English translations of foreign titles of importance, although numerous outstanding and untranslated items in French, German, and other foreign languages are also included.

I

Aiming as it does to be a general handbook for American students, the *Guide* includes primarily what might be regarded as ready first readings rather than exhaustive bibliographic references. It is not " even a reasonably complete bibliography in any field." This limitation should be hailed as a decided virtue, provided it is held in mind by users. In a day when " exhaustive " bibliographies are still customarily regarded (even by those who should know better) as a badge of scholarship, while as a matter of fact almost any clerk can " compile " one from a good library catalogue, and when the inclusion of foreign titles *ad libitum* is too frequently looked upon as the *sine qua non* of learning, it is a wholesome shock to witness this courageous stand by American scholars for careful selection of references and for sanity with respect to the mother tongue.

Such an observation is not intended to minimize the need in sound scholarship for a command of several of the modern languages, but rather to emphasize the fact (too often overlooked) that the need is an obstacle and a hindrance rather than a blessing, except for those who make linguistics their specialty. That important source material in Greek, Latin, Arabic, Sanscrit, and other ancient tongues still remains inaccessible to most modern scholars because it has not yet been translated into one of the modern languages, has finally come to be recognized as a sufficiently important handicap to the progress of Western learning in general, to warrant the taking of more constructive and effective steps (such as large-scale and cooperatively financed translation enterprises) to remedy the difficulty, instead of depending as formerly on the antiquated measure of expecting most specialists in historical, social, and scientific fields to acquire a working knowledge of " ancient language " in addition to becoming proficient in their specialties. Simil-

arly the time would seem to be ripe for the further recognition that not every present-day scholar is by nature gifted in acquiring modern foreign languages besides becoming a master in his chosen field. The greatest of scientists or historians may be the poorest of linguists, in which case it is utter folly to insist on mixing " oil with water " when translators and linguistic assistants would be the more suitable solutions. So long as English scholars in special fields other than linguistics are forced, regardless of aptitude, to secure a smattering of several languages, rather than being free to perfect the chief medium of their expression, no full encouragement to English scholarship as such is afforded,—no preeminent historical, social, or scientific American literature is to be expected. So that, while recognizing the continuing linguistic requirements mentioned above, the reviewer makes bold to emphasize certain shortcomings and to express the hope that the publication of an historical reference book of English works mainly, will result in a more thoroughgoing recognition of the English-speaking scholar's need for effective linguistic assistance in the form of prompt authoritative translations and otherwise. (1) Praise is due the editors of the *Guide* for their excellent example in excluding as many foreign works as possible (and at that they were forced to include a great number) rather than the condemnation which is sure to come from many quarters because of such omission.

II

The division of the *Guide* into twenty-six major sections, each corresponding to a letter of the alphabet, has much to commend it from the points of view of mnemonics and ease of reference, and on the whole there is little to criticize in the major groupings thus arranged, although here and there the divisions were bound to be somewhat arbitrary, since there is nothing particularly panacean or all-inclusive in the number twenty-six. The plan has apparently been to cover the most general aspects of world history first, moving in fairly strict chronological order

(1) A suggestion with respect to the systematic handling of the problem of rendering important foreign works more expeditiously into English, may be ventured. Large universities might develop for their research professors a limited " translation service," recruited from their foreign language departments or otherwise, to be used in the first instance for translating special sections of books and for digesting introductions and conclusions of works regarded as important. In some instances, full translations of outstanding works might be undertaken either by a given university " translation service " or jointly with similar services operated by other institutions or libraries. At the same time a central clearing house could be established for making works or selections thus translated readily available to other scholars.

from sections B through J (embracing pre-historic, ancient, medieval, modern, and contemporary times), and then, after a transitional section on Exploration and Colonial Expansion, to devote the remaining divisions to special national and regional histories covering for the most part the modern and contemporary periods. Such a movement from the general, less differentiated, and ancient, to the concrete, complex, and modern, follows fairly well the course of history, and its faithful delineation in a work of reference should facilitate and simplify use.

It is important, however, to hold in mind in what respects this general plan was not consistently followed, since the incongruities will undoubtedly result in some misconception and confusion. The most significant discordance in this connection pertains to the ancient Far East, references with respect to which, instead of being listed under the ancient period (sections C through G), have been included with medieval and modern references (under U). This contradiction is the more unfortunate in that it lends color to the deep-seated (albeit erroneous) belief among western peoples that the ancient Far East contributed little or nothing to the development of European civilization. Quoting from the *Guide* (p. 853): " We are not much interested in the history of Southern Asia before European imperialism laid its hand upon India, nor does the history of the peoples of eastern Asia appeal to us prior to the development of western intercourse in the nineteenth century." It is admitted that " the earlier history of these regions has not yet received adequate consideration from the western world," but what is overlooked is that we already possess considerable evidence, despite language handicaps, of the impressive cultural contributions of ancient India (e.g., in algebra, the " Arabic " notation, and religion) and of China (e.g., in technology, philosophy, and medicine) to medieval and modern civilization and even to the later cultural developments of Greece and Rome. Both consistency and an unbiased world-view suggest that references to the ancient Far East, meagre though they may be, should have been listed in earlier sections of the *Guide*, with brief cross references under U, as has been so admirably done in most of the other sections.

Certain other deviations from the indicated general plan were apparently unavoidable and probably desirable, although some explanation regarding them should have been included in the preface or in a general introduction, a matter to be referred to again presently. Such deviations occur for the most part where antecedent ancient or medieval events, bearing on the rise of some modern nation or region, are not taken cognizance of in the earlier more strictly chronological sections (except possibly with a brief cross reference), but are listed later under the particular nation or region in question, usually under the subheading, " histories

of special periods, regions, or topics." Examples of such divergence will be found under " Great Britain and Ireland " (p. 493), " France " (p. 578 ff.), " Spain and Portugal " (p. 645), " Italy " (p. 669 ff.), " Germany, Austria, and Switzerland " (p. 705 ff.).

Cross references with respect to the major sectional divisions are usually well worked out and are for the most part contained in the introductions to the several sections, which likewise often contain other bibliographical suggestions of value. But unfortunately not all of the introductions have been developed with equal care and detail. Among the best is the introduction to section T; an example of an inadequate one is that which prefaces section A; the few meagre words introducing section B offer almost no assistance at all.

III

Besides the division into twenty-six major sections, there is incorporated a much-used historical scheme of uniform sub-divisions and enumeration, one of the most consistent features of the *Guide* but, also, unhappily, most open to criticism. It is time that this orthodox topical arrangement be challenged. Sooner or later something much more thorough and logical must be devised, reflecting not only the point of view of the average historian but also that of other specialists in social study. When it is stated that the 12,000 or more titles contained in the *Guide* have been carefully selected and analyzed by over 350 contributors in various social fields (a splendid cooperative venture), it should at the same time be noted that the general board of editors and the twenty-six or more section editors are all historians. The scheme of classification undoubtedly emanated from this group; it has been used by historians before and bears no evidence that other specialists among the social scientists were consulted in giving it its present form. Otherwise, some of the crudities about to be mentioned would surely not have survived, —not that other students of society are necessarily more knowing, but simply that some of the concepts incorporated in the scheme, which is given below, fall more particularly in their ken.

Scheme of Classification and Enumeration used in the " Guide "

1-20	Bibliography, library and museum collections.
21-40	Encyclopedias and works of reference.
41-50	Geography and atlases.
51-60	Ethnography, ethnology, and anthropology.
61-100	Source books, collections of sources, archive publications.
101-120	Shorter general histories.
121-200	Longer general histories.

201-500 Histories of special periods, regions, or topics.
501-530 Diplomatic, military, and naval history, international law.
531-570 Constitutional and legal history, political theory.
571-600 Economic and social history.
601-700 Cultural history.
- 601-620 Cultural history : general.
- 621-640 Cultural history : religion.
- 641-660 Cultural history : education, thought, philosophy, science.
- 661-680 Cultural history : literature.
- 681-700 Cultural history : art and music.

701-900 Biography.
901-920 Government publications.
921-940 Academy, university, and society publications.
941-1000 Periodicals.

In section A, " History and Auxiliary Sciences," mention is made of geography, anthropology, ethnography, ethnology, chronology, philology, genealogy, archaeology, epigraphy, numismatics, and other specialties as sciences auxiliary to history—these are comprehended for the most part in the scheme of subdivisions under geography and anthropology (2)—but not a word is said regarding the special social sciences of law, political science, sociology, economics, comparative religion, and education, nor regarding the several physical and natural sciences and the other disciplines mentioned in the scheme. Failure to indicate in either section A or B the relationship of these special sciences to history is somewhat curious, to say the least, since they are made use of in every section under the schematic subdivisions listed. The user of the *Guide* might even infer that geography and anthropology and the other " auxiliaries " are sciences in their own right, whereas the additional disciplines mentioned exist only as a part of history. Again, why should political theory continue to be singled out for mention and inclusion and the theoretical aspects of the other social sciences be ignored and omitted? Once more, what kind of perspective is implied where education, philosophy, science, and thought, are bunched together and given 20 catalog numbers out of a thousand? And how is one expected to visualize " thought " as coordinate with education, philosophy, and science? Most important of all, had competent anthropologists or sociologists been consulted, the words " cultural " and " social " could hardly have been left in or incorporated into the scheme in the manner indicated. (3)

(2) Designated ethnography and ethnology except as bearing on pre-history.

(3) In the bibliographical supplements to the Annual Reports of the American Historical Association, beginning with 1906, very much the same scheme of classification appears and continues virtually unchanged from year to year, except

The term " culture " has in late years been brought into prominence through the researches of the anthropologist on pre-historic and primitive societies (cf., e.g., CLARK WISSLER, " Man and Culture ") and is now being applied by the sociologist to every type of society or civilization, whether ancient or modern. In its technical significance it has come to comprehend : (1) material objects, such as tools, instruments, machines and other products of the artifice of man; (2) individual skills, techniques, crafts, trades, etc.; (3) institutions and customs, i.e., the traditional ways and social conventions to which individuals conform. In a similar sense, the term " social " has come to have an all-inclusive significance, being used by the sociologist to designate any human activity which is the result of living together in society. In short, history is the record of socio-cultural events; there are no other events in history. It is important, to be sure, that the historian know something of the environment and the ethnic factors involved in the events recorded (hence the inclusion of geography and anthropology) and that the student be familiar with the sources from which the record is compiled (comprehended under the first, second, fifth, and the last three subdivisions of the *Guide's* scheme of classification). The significant point here is that all these considerations could have been readily taken into account, and the points of view of the historian and social scientist reconciled, without doing violence to any of the sub-headings of the scheme, if these had been grouped under three divisions; viz. : (1) Geographic and ethnic backgrounds; (2) Sources, general and special histories; (3) Cultural-social-institutional factors. With the exception of lifting " cultural " and " social " from the sub-headings, eliminating " thought," and separating " education, philosophy, and science," all the other items would have remained. This is not to imply that no criticism can be brought against the classification scheme other than that just indicated. But such further analysis (as, for example, that having to do with the place assigned to archaeology and sociology) is too technical for inclusion here and would take us too far afield. All that it is hoped to accomplish in this part of the review is to point out the confusions, difficulties, and important omissions resulting from the use of a classification scheme

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that in the topical arrangement the word " science " does not appear till 1918, and the headings " philosophy " and " culture " are absent altogether. It is illuminating to contrast this orthodox point of view among certain American historians with the point of view adopted by the French and English historians in the past decade, and particularly with that which permeates the " History of Civilization " series of volumes being edited in France by Professor HENRI BERR (*L'Évolution de l'Humanité*) and in England by Professor C. F. OGDEN.

open to the suggested criticisms. Illustrations of these difficulties and omissions follow.

Examples in the *Guide* of confusion due to the restricted use made of the concepts " social " and " cultural " are numerous. In virtually every instance where the word " social " is used in a heading, the titles listed deal wholly with economic factors, and, although military, constitutional, political, legal, economic, and " social " references are all presumably included before the " cultural " subdivisions are reached, they are nevertheless very often found also under the " cultural " headings, usually under " cultural : general " (cf., e.g., pp. 98-99, 133-134, 547-548, 552, 619, 655, 740-741, 768-769, 789, 796, 900, 1042-1043, 1085).

That the words " social " and " cultural " were given the restricted meaning indicated and " education, thought, philosophy, and science " were all squeezed together in a minor subdivision under " cultural," has not only resulted in the conventional emphasis upon general, military, political, and legal history but also in some very serious omissions with respect to and within the compressed " education-thought-philosophy-science " category. In over half of the twenty-six major sections, the " education-thought-philosophy-science " subdivision is entirely omitted ! And in most of the others it has received very inadequate consideration even as a compressed whole, much less allowing separate treatment for educational, philosophical, and scientific developments in modern civilization. Among those major sections in which the compressed heading as such is omitted entirely are : " Near East in Ancient Times," " Modern Europe," " Contemporary Times," " Spain and Portugal," " Netherlands and Belgium," " Scandinavian Countries," " Southeastern Europe and Southwestern Asia, " " Asia, including India, China and Japan," " Hispanic America, " and " British North America," although a scattered number of titles on education, philosophy, or science pertaining to these countries or regions are sometimes included under " cultural : general." The following additional comments will indicate further how these important topics have been slighted. Under the " History of the Moslem Peoples" (races that did so much to keep science and learning alive during the middle ages) only two titles are entered under " Thought and Philosophy " (p. 292), one on medicine, the other on philosophy, nothing on science proper; under " Modern Europe " there are only a half dozen entries covering the whole field of modern " cultural " history (pp. 370-371), most of them on philosophy, with only brief mention of science and (pp. 329-330) general reference for further details to the nationalistic sections; under " Contemporary Times " (p. 425) even less regard is shown for these important disciplines, the six entries mentioned

under " Modern Times " being specifically referred to as " many works " (!) and reference being again made to " the several sections devoted to particular nations." Running through these special nationalistic sections, one finds, if anything, even scantier consideration. Under " Great Britain and Ireland " (p. 552), no works at all on science are included; under " France " (pp. 622-623), only two entries on science are given and the word is omitted from the subheading; under " Spain and Portugal " (p. 655), " Italy " (p. 689), " Germany, Austria, and Switzerland " (pp. 740-741), " The Netherlands and Belgium " (pp. 756-757), " Scandinavian Countries " (pp. 768-769), " Russia, etc." (pp. 789, 796), " Southeastern Europe and Southwestern Asia " (p. 815), " Asia, including India, China, and Japan " (pp. 877, 900, 921-924, 939-943), " United States " (p. 1044), " Hispanic America " (p. 1085), and " British North America " (p. 1097), not to mention the less important nations and regions,—under these, the entire sub-section is omitted in nearly all instances, works on science are altogether missing, and the included references on education and philosophy are so meagre that they may be regarded as negligible.

IV

Certain additional comments of varying significance remain, including two other instances of important series of omissions. One of these has to do with references on anthropology (ethnography and ethnology), only about half the sections including items pertaining to these subjects. Such data are omitted under " Greece," " Rome," " The History of Christianity," " Medieval Times," " Modern Europe," " Great Britain and Ireland," " Spain and Portugal," " Germany, Austria and Switzerland," " Netherlands and Belgium," and the " Scandinavian Countries." On the other hand, ethnographic references are included under " History of Mohammedanism," " France," " Italy," " Russia, Poland, etc.," " Southeastern Europe and Southwestern Asia, " " Asia, including India, China, and Japan," " Oceanica," " Africa," " United States," " Hispanic America," and " British North America." The other additional group of omissions has to do with the up-to-dateness of the references included in the *Guide*. In this respect the sections are very unequal. In some there are no titles more recent than 1925; in others, entries have been included with publication dates as late as 1930. Whether this discrepancy arose because of the change in the chairmanship of the committee or because of haste on the part of the publishers in setting up in print a portion of the *Guide* five years before the remaining part was in any sense ready, it is hard to say; but, at any rate, the fact

of the discrepancy is another matter which would seem to be of sufficient significance for explanation in an introductory statement.

Several intimations have already been given regarding the value of introductory directions for users of the *Guide*. In putting forth a manual of this character, there should certainly have been included a preliminary section in which full explanation of limitations and scope, together with an amplification of the misplaced " directions " under " Index I," would have been incorporated. To begin with, the scheme of classification is not an " index"; it is called " contents " twenty-six times at the beginnings of the various sections; and in general it is important enough to receive complete elucidation at the outset. The few words vouchsafed under " Index I," in less than half a page of large type, are entirely inadequate, and the scheme of classification as listed there (p. 1099) deviates from the listing elsewhere in the *Guide*. Under the class 641-660 the word " science " is once more left out, whereas it often appears in the section subheadings; under 51-60 ethnology and anthropology should have been added to give the full scope of material included under this classification in various sections (cf. p. 13 of the *Guide*). These discrepancies are important since users of the *Guide* will naturally turn to " Index I " for an explanation of the scheme of classification and enumeration used and should find the complete classification there if anywhere. A minor inadvertence is the inconsistent use of capitals in the first two lines of the scheme. From the point of view of enumeration, it might have been less confusing to use the 0—9 grouping rather than the 1—10.

Comments on less important omissions and discrepancies may be dispensed with. In a work of this scope, they are unavoidable. A number of them (such as misspellings, wrongly classified references, discrepancies in the use of diacritical marks) have already been called directly to the attention of the editors by the writer, as will undoubtedly other errors as they are located by users of the *Guide*. In this connection, the admirable example set by *Isis* in publishing in current issues corrections to SARTON's *Introduction to the History of Science* as they are sent in by readers, might well be followed by the *American Historical Review* with respect to corrections to the *Guide*. As for the exclusion of specific titles, quite apart from the broad categories of omissions regarding which detailed comments have been submitted, various specialists will undoubtedly have differences of opinion as to what references should have been included under the prescribed categories, but here the fact that outstanding historians have made the selections should be sufficient to assure confidence in the competence of the results within the confines of the scheme of classification used and the limitations of the work as

deliberately set by the board of editors. Despite its significant shortcomings, apart from its necessary limitations, the *Guide* must be recognized as a manual of outstanding importance and should have an extensive use.

V

In conclusion, attention is again drawn to the serious shortcomings of the scheme of classification. The significant omissions and meagre references already discussed in detail, regarding important historical subjects, particularly science, in the face of the large amount of historical material available, would seem to suggest a widespread antagonism on the part of historians (or at least a blind spot) with respect to matters scientific. That there is an essential difference between the historical and scientific points of view it is well to admit, but that they should be regarded as antagonistic rather than supplementary is unfortunate. Historians in late years have come more and more to recognize the necessity of analysis and interpretation, both of past and contemporary events, to a full understanding of the development of civilization; and outstanding scientists, in the natural as well as in the social fields, have come to appreciate the value of historical perspective for a proper orientation in their disciplines. The consequence has been that there have been " encroachments " on the part of both the historians and the scientists (witness the listing of courses in any university catalog) with a resulting aloofness and sometimes a distrust which are to be deplored. There is urgent need for give and take in both camps, and for cooperative effort in a joint enterprise.

There is in reality no fundamental conflict between the historical and the scientific points of view. They apply to the same group of phenomena and their approaches, though different, are complementary. One is longitudinal in view; the other, latitudinal. One is retrospective; the other, cross-sectional. One is primarily descriptive; the other, analytical. And it is the judicious mixture of both which goes to produce a worth-while modern scholar in the social studies. Today no longitudinal, retrospective, descriptive view alone is sufficient; nor is one that is wholly latitudinal, cross-sectional, and analytical. If the blend has more of the one set of ingredients, the result is an historian; if more of the other, a social scientist. But it is the blend which is essential to present-day scholarship and the quicker this fact is faced squarely, the better it will be for the advance of learning in matters social. Historians and social scientists should as a whole labor shoulder to shoulder in a common cause (as some of them already do) rather than treat each other as aliens or as enemies. Be the virtue of these strictures

what they may, it is obvious that the *Guide* represents a circumscribed point of view, whereas, with very little extra effort and taking of counsel, it could have been made truly comprehensive in scope.

Library of Congress JOSEPH MAYER.
Washington, D.C.

Henry Rose Carter. —*Yellow Fever.* An epidemiological and historical study of its place of origin. Edited by LAURA ARMISTEAD CARTER and WADE HAMPTON FROST. XII+308 pp., 5 figs. including 3 maps. Baltimore, WILLIAMS & WILKINS Co., 1931. (Price $ 5.00.)

The historical significance of this investigation is heightened greatly by the fact that its author had a first-hand knowledge of the disease, a long experience in the study of its epidemiology, and an intimate knowledge of the life habits and life history of its insect vector, a mosquito commensal of man, peculiarly adapted to live in and about his habitations and to travel with him by ship and train, the mosquito known as *Aedes aegypti*. Added to these qualifications is the wealth of knowledge now available on the various diseases, such as malaria, typhus, relapsing fever, and leptospiral jaundice, which have, or might have, been confused by uncritical observers with yellow fever in the past records of epidemics. With this background of epidemiological experience Dr. CARTER has been able to critically assess the writings of historians and of explorers who witnessed the ravages of this and other diseases of the African and American tropics, but were ignorant alike of the sources of the infection and biological reasons for the selection of its victims and its mysterious assaults and equally puzzling cessations.

The treatise opens with a discussion of the now well known epidemiology of yellow fever, which is followed by a discussion of all of the tropical epidemic diseases and the characteristics which differentiate them, a knowledge of which is essential in interpreting the writings of historians, explorers and the earlier medical lore of the Amerind and Spanish sources, and those of the early explorers of West Africa.

Two strongly defended theories as to the place of origin of yellow fever have held the attention of epidemiologists. Dr. CARLOS J. FINLAY of Cuba and BÉRENGER-FÉRAUD defend the opinion that it originated in tropical America, while Dr. CARTER defends its origin in West Africa between the Congo and Senegal. In defence of this thesis he has examined critically the Aztec and Mayan records of epidemics prior to the advent of Europeans and concludes that the « *xekik* » or blood-vomit of the ancient Mayan records was not yellow fever and that prior to 1648 the evidences for the occurence of this disease in the later known endemic centers, to wit : the *terra caliente* about Vera Cruz, the Mayan

center in Yucatan, the Panamic region, and Caribbean are entirely negative. The recorded epidemics afford evidence that the writers were cognizant of recurrent epidemics, but those which they describe either do not accord with the epidemiology of yellow fever or can be definitely ascribed to small-pox, measles, typhus, malaria, or a combination of typhus and relapsing fever.

The first clearly defined epidemic of yellow fever in America was in Yucatan in 1648 following greatly increased activity among the buccaneers in Caribbean waters and followed by the outbreak of the « peste », clearly yellow fever, several months later at Guadaloupe, and in Havana a year later. The Spaniards had been in Yucatan for 120 years without an unquestioned record of the disease. The epidemic had all the characteristics of an occurence in a virgin field and the accounts of it bear witness to its novelty.

Once established it remained endemic in suitable localities where *Aedes aegypti* breeds abundantly, where the community is sufficiently large and fecund, and the immigration of non-immunes is large enough to maintain a continuity of infection in man and mosquito. The disease often passes unobserved in young children, while the immigrant susceptible adult falls a victim, as did the French at Panama during the De Lesseps regime.

The epidemiological evidence sifted from the Spanish accounts of disease among the expeditions and campaigns of the conquistadores is all negative up to 1648. By that time the African slave trade and the activities of the buccaneers had transferred the insect vector from Africa, where all of its relatives occur, to the breeding grounds in the new settlements in America. Some unrecorded vessel brought the contagion among the negroes from the Slave Coast to American shores, and when the mosquito came also, or was already established in the port where the stricken crew arrived, all conditions were fulfilled for the continuance of the disease in the Western continent.

The evidence from African sources is less convincing, not so ancient, and much less abundant than from American sources. The reasons for this are that the negro reacts to the toxins of the infection less violently, the infection probably occurs regularly in children in infected communities, by reason of which they are immune in later life, foreign settlements are few and small, and foreign travel is light in the endemic area of Africa. Furthermore, the African native has no written records and the African trader rarely publishes his memoirs. For these reasons yellow fever was known in America 130 years before it was recorded by Schotte in Africa in 1778. There are, however, records of disease among the crews of trading vessels, especially those ascending the rivers, such

as that of BERNALDEZ in 1471. He tells of the major part of his crew sickening and dying without remedy, but that the survivors « became well and ceased to die. » Evidences of the disease in small groups of Europeans occur in the accounts of commercial voyages of the 15th century, in those of settlements on the islands off the coast, and in fleets which visited them. The disease has been reported mainly, if not wholly, only in connection with white settlements or in visitors, and comes to note, not in the natives, except among children, where it is light in character, only when the more susceptible adult European is the victim. The biological evidence combined with the historical records of epidemics of the disease in both continents, especially where these are interpreted in the light of epidemiological knowledge and probabilities, make out a strong case for the origination of yellow fever in the Negro of West Africa and its transfer and that of its insect vector, *Aedes aegypti*, to America with the slave trade or other agencies of human transport about the middle of the 17th century.

C. A. KOFOID.

Celebration of the Centennial of the Library of the Medical and Chirurgical Faculty of the State of Maryland, 1830-1930. XII+78 p., 34 pls. Baltimore, Maryland, 1931.

In this anniversary volume are to be found historical essays upon « A century of American medical libraries, 1830-1930 » by Dr. ARCHIBALD MALLOCH, on « The development of internal medicine during the past one hundred years » by Prof. L. F. BARKER, on « Surgical progress of the century » by Dean IRVING S. CUTTER, and on « Progress of medical specialities » by Dr. JOSEPH COLLINS. The origin and growth of the library and an account of its founder follows, and the work closes with an address by Dr. WILLIAM H. WELCH on « Medicine in 1830 ». In this address the fundamental influence of BICHAT at the opening of the last century upon medicine in France is noted. The brilliant school which rose thereafter in Paris included among others LAENNEC, CHOMEL, LOUIS, and CRUVEILHIER. The influence of this school spread rapidly to Dublin, London, and Vienna, and many American physicians who studied under LOUIS brought his influence to the United States, thus giving to him a prominence here in advance of that he won at home. Foremost among those who brought to America the spirit of the French school was Dr. WILLIAM POWER, who applied the doctrine of the specificity of disease of BRETONNEAU of Tours to the much disputed problem of the distinction between typhus and typhoid fevers. In 1847 POWER noted the fact that among patients in the Baltimore Almshouse recovery from the one disease protected against a second attack of that disease,

but had no protective influence against an attack by the other disease. Each of the two diseases produced its own specific immunity, but no cross immunity against the other. These facts were noted, but their technical interpretation awaited the discovery of the typhoid bacillus to command widespread acquiescence in the view that POWER defended. This library owes its origin indirectly to these transplanted influences of the French School.

CHARLES A. KOFOID.

Thirty-Second Critical Bibliography

of the

History and Philosophy of Science and of the History of Civilization

(to October 1931)

This thirty-second Bibliography contains about 1175 items, some of which have been kindly contributed by the following scholars :

C. W. ADAMS *(Hertford, England)*
R. C. ARCHIBALD *(Providence, R. I.)*
T. L. DAVIS *(Cambridge, Mass.)*
L. GUINET *(Brussels)*
C. A. KOFOID *(Berkeley, Cal.)*
J. PELSENEER *(Brussels)*
L. SAPIN *(Brussels)*
M. C. WELBORN *(Cambridge, Mass.)*
J. K. WRIGHT *(New York)*.

It includes the fourteenth series of addenda and errata to Volume I of the *Introduction to the History of Science* (Baltimore and London, 1927.)

Papers and books sent to the Editor are entered into this bibliography if they are relevant to its purpose. They may be the object of analytical notes or longer reviews, if this seems sufficiently necessary and the services of competent scholars are available. It is obvious that only a small number of publications can be adequately reviewed and that it is not even possible to give a brief description of each and every one. However, our classification is so comprehensive and so minute, that even if we do nothing but give the accurate title of an item and put it in the proper place, we are already rendering a real service to the author, the publisher and the learned public. There is no relation between the importance of a publication and the length of the note devoted to it.

The ultimate aims of this undertaking are : (1) to establish the History of Science as an independent discipline ; (2) to demonstrate inductively the Unity of Knowledge and the Unity of Mankind ; (3) to serve as a center of information and rallying ground to the scholars engaged in our studies.

Harvard Library, Rooms 185-189.
Cambridge, Massachusetts.

GEORGE SARTON.
ALEXANDER POGO.
November 9, 1931.

PART I

FUNDAMENTAL CLASSIFICATION (CENTURIAL)

IXth Century B.C.

Bérard, Victor. Did HOMER live? Translated by BRIAN RHYS. 234 p. London, DENT, 1931. ISIS

Bowra, C. M. Tradition and design in the Iliad. VIII+278 p. Oxford, Clarendon Press, 1931. ISIS

Fuld, Ernst. Bemerkungen zu der Abhandlung und Entgegnung O. KÖRNERS. *Archiv f. Geschichte der Medizin*, 24, 202—04, 1931. ISIS

Apropos of KÖRNER's paper on Homer, *ibid.*, 24, 185-201.

(Homer). HOMERI Ilias. Edited by THOMAS W. ALLEN. In three volumes. Vol. I. Prolegomena, VIII+278 p.; vol. II. Books I-XII, XIV+356 p.; vol. III. Books XIII-XXIV, XIII+390 p. Oxford, Clarendon Press, 1931. ISIS

(Homer). Iliade. Traduction française par VICTOR MAGNIEN. 624 p., 2 maps. Paris, PAYOT, 1930. ISIS

Comme il ne m'appartient pas d'apprécier, au point de vue de la fidélité au texte homérique cette traduction nouvelle de l'Iliade, je la signale à cause surtout de son introduction (90 p.) dont une bonne partie est un résumé extrêmement concis de la civilisation homérique : les dieux, les héros, l'homme, le monde et la nature, la société, habitation, vêtement, nourriture, etc...

L. G.

Körner, Otto. Über Spuren des jonischen Forschungstriebs in Ilias und Odyssee und über die Verwertung homerischer Erkenntnisse im Corpus Hippocraticum und in der Tiergeschichte des ARISTOTELES. Zugleich eine Entgegnung auf die Kritik von FULD in dieser Zeitschrift, Bd. 23, 152-183. *Archiv f. Geschichte der Medizin*, 24, 185-201, 1931. ISIS

Larock, V. Les premières conceptions psychologiques des Grecs. *Rev. belge de Philologie et d'Histoire*, 9, 377-406, 1930. ISIS

VIIIth Century B.C.

Wilamowitz-Moellendorff, Ulrich v. HESIODOS Erga. 166 p. Berlin, WEIDMANN, 1928. ISIS

Reviewed by RICHARD HARDER, *DLZ*, 2, 487-99, 1931.

VIIth Century B.C.

Welch, A. C. JEREMIAH. His time and his work. VIII+263 p. Oxford, University Press, 1928. ISIS

Reviewed by P. VOLZ, *OLZ*, 34, 446-49, 1931.

VIth Century B.C.

Schubring, Walther. Worte MAHĀVĪRAS. Kritische Übersetzungen aus dem Kanon der Jaina, von WALTHER SCHUBRING. IX+152 p. (*Quellen der Religionsgeschichte*, Gruppe 7.) Göttingen, VANDENHOECK & RUPRECHT, 1927. ISIS

Reviewed by L. D. BARNETT, *Journal of the Royal Asiatic Society*, 492, 1931.

Waldschmidt, Ernst. Die Legende vom Leben des BUDDHA. In Auszügen aus den heiligen Texten. Aus dem Sanskrit, Pali und Chinesischen übersetzt und eingeführt. Mit vielen zum Teil farbigen Illustrationen wiedergegeben nach tibetischen Tempelbildern aus dem Besitz des Berliner Museums für Völkerkunde. 248 p. Berlin, Wegweiser-Verlag, 1929. ISIS

Reviewed by W. STEDE, *OLZ*, 34, 263-64, 1931.

Vth Century B.C.

Edelstein, Ludwig. *Περὶ ἀέρων* und die Sammlung der Hippokratischen Schriften. VI+188 p. (*Problemata. Forschungen zur klassischen Philologie*, H. 4). Berlin, WEIDMANN, 1931. ISIS

Fraser, Everard D. H. Index to the Tso Chuan. Revised and prepared for the press by JAMES HALDANE STEWART KLOCKART. 430 p. Oxford, University Press, 1931. ISIS

Herrmann, Albert; Hennig, Richard. Gibt es noch ein Oxusproblem? *Petermanns Mitteilungen*, 76, 286-89, 1930. ISIS

Two papers. A. HERRMANN's conclusions: "Also auch nicht eine von diesen Angaben passt auf die Wolga; entweder bezeichnet der Araxes den armenischen Fluss oder — in den häufigsten Fällen — den Amu und seinen kaspischen Mündungslauf. So gewinnen wir denn auch auf diesem Wege von neuem die Überzeugung, dass es ein Oxusproblem nicht mehr gibt." R. HENNIG, on the other hand, defends his "in monatelangem Ringen aufgestellte Gleichung: Araxes des HERODOT = Wolga."

A. P.

Levi, Adolfo. Le teorie metafisiche, logiche e gnoseologiche di ANTISTENE. *Revue d'histoire de la philosophie*, 4, 227-49, 1930. ISIS

Luccarelli, Vincenzo. ICCO DA TARANTO. *Riv. di storia d. sc. med. e natur.*, 21, 209-11, 1930. ISIS

ICCO est un médecin et athlète de Tarante appartenant à la première moitié du V^e^ siècle av. J.-C., à qui revient le mérite de l'invention de la diététique et de l'application de la gymnastique à la médecine. L. G.

Peters, Norbert. Das Buch Job ; übers. u. erklärt. XXVIII+99+517 p. (*Exegetisches Handbuch zum Alten Testament*, 21. Band.) Münster i. W., ASCHENDORFF, 1928. ISIS

Reviewed by F. BAUMGÄRTEL, *OLZ*, 34, 449-51, 1931.

Solovine, Maurice. HÉRACLITE D'EPHÈSE, doctrines philosophiques, traduites intégralement et précédées d'une introduction par MAURICE SOLOVINE. XL+102 p. Paris, ALCAN, 1931. ISIS

Reviewed by P. J. RICHARD, *Revue générale des Sciences*, 42, 379-80, 1931.

IVth Century B.C. (whole and first half)

Deschamps, Aug. L'idée communiste chez PLATON. *Revue générale des sciences*, 42, 73-79, 1931. ISIS

Gronau, Karl. PLATONS Ideenlehre im Wandel der Zeit. 230 p. Braunschweig, WESTERMANN, 1929. ISIS

Reviewed by ERNST HOFFMANN, *DLZ*, 2, 1059-63, 1931.

Herrmann, Albert. Forschungen am Schott el-Djerid und ihre Bedeutung für PLATONS Atlantis. *Petermanns Mitteilungen*, 76, 169-74, 1930. ISIS

IVth Century B.C. (second half)

Aristotle. The works of ARISTOTLE translated into English. De anima. By J. A. SMITH. III+92 p. Oxford, Clarendon Press, 1931. ISIS

Jolivet, R. ARISTOTE et la notion de création. *Revue des sciences philosophiques et théologiques*, 19, 5-50, 209-35, 1930. ISIS

Lulofs, H. J. ARISTOTELES over de Zee. Specimen van antieke hydrographie. (*Geographische en geologische mededeelingen*: physiographisch geologische reeks n. 4). Utrecht, 1930. ISIS

Marguerite, Henry. La composition du livre A de l'Ethique à NICOMAQUE. *Revue d'histoire de la philosophie*, 4, 250-73, 1930. ISIS

Schilling, Harald. Das Ethos der Mesotes. Eine Studie zur nikomachischen Ethik des ARISTOTELES. IV+103 p. (*Heidelberger Abh. z. Philos. u. ihrer Gesch.* hrsg. v. ERNST HOFFMANN und HEINRICH RICKERT. Bd. 22). Tübingen, MOHR, 1930. ISIS

Reviewed by FRIEDRICH SOLMSEN, *DLZ*, 2, 447-51, 1931.

Scholz, Heinrich. Die Axiomatik der Alten. *Bl. Deutsch. Philos.* 4, 259-78, 1930. ISIS

Wilcken, Ulrich. ALEXANDER DER GROSSE. XI+316 p., map. (*Das wissenschaftliche Weltbild.* Hrsg. von PAUL HINNEBERG.) Leipzig, QUELLE & MEYER, 1931. ISIS

Reviewed by WALTHER KOLBE, *DLZ*, 2, 884-95, 1931.

IIIrd Century B.C. (whole and first half)

Gardiner, Edward Norman. A school in Ptolemaic Egypt. *The Classical Review*, 44, 311-13, 1930. ISIS

Bell, H. I. Waxed tablets of the third century B.C. *Ancient Egypt*, 65-74, 1927. ISIS

"A considerable number of waxed tablets have been found in Egypt during the last half-century, besides those discovered elsewhere, as at Pompeii and Verespatak, but those published below, though they contain only accounts, have a special interest, since they are, so far as I can discover, the earliest examples at present known. They were acquired, with many other objects from the Fayyum, in the season 1889-90, by Sir FLINDERS PETRIE while living at Illahûn, and to his kindness I am indebted for permission to publish them. The various hands observable in them are all unmistakably of the 3rd century B.C., and almost certainly date from about the middle of that century, since they show a close resemblance to those seen in the well-known ZENO papyri. A further point of interest is that in several cases the wax is coloured red. I have in my transcript noted the colour of each page; it will be seen that the same tablet may have red wax on one side and black wax on the other."

Junge, Gustav. Ein schwieriges Kapitel der Elemente EUKLIDS. *Forschungen u. Fortschritte*, 7, 55, 1931. ISIS

IIIrd Century B. C. (second half)

Fazy, Robert. Note sur une éclipse du temps d'AÇOKA (?). *Journal asiatique*, 217, 135-36, 1930. ISIS

Lambossy, P. ARCHIMEDE. Le Traité des corps flottants et le Traité

de la méthode. *Bull. Soc. Fribourgeoise Sc. Nat.*, 29, 20-39, 1 fig., 1929. ISIS

Lethaby, W. R. Alexandrian world maps. *Ancient Egypt*, 106, 1920. ISIS

Apropos of ERATOSTHENES' maps and later ones.

G. S.

Milne, John J. The story of a problem and its solution. *Mathematical Gazette*, 15, 142-44, 1930. ISIS

The 'locus ad tres et quatuor lineas' problem in the third book of the Conics of APOLLONIUS, its discussion by PAPPUS, DESCARTES, and NEWTON, and its retranslation and elucidation by the writer in 1894.

C. W. A.

IInd Century B.C. (whole and first half)

Odeberg, Hugo. Qohaelaeth. A commentary on the Book of Ecclesiastes, 128 p. Uppsala, ALMQVIST & WICKSELLS, 1929. ISIS

Reviewed by CURT KUHL, *OLZ*, 34, 232,1931.

Ist Century B.C. (second half)

Bullón y Fernández, Eloy. La cultura geográfica de VIRGILIO. *Boletín de la Real sociedad geográfica*, 70, 377-86, 1930. ISIS

Klotz, Alfred. Die geographischen commentarii des AGRIPPA und ihre Überreste. *Klio*, 24, 38-58, 1930. ISIS

Lulofs, H. J. Degeneratie der Galaten. Een anthropologisch moment bij LIVIUS. *Bijdragen tot de geschiedenis der geneeskunde*, 11, 147-52, 1931. ISIS

(Virgil). Numero di natale e capodanno della Illustrazione Italiana a cura di VINCENZO USSANI e LUIGI SUTTINA. 68 p., fig., pl. Milan, TREVES, 1930/31. ISIS

Reviewed by K. STRECKER, *DLZ*, 2, 929-31, 1931.

Ist Century (whole and first half)

Adler, Maximilian. Studien zu PHILON VON ALEXANDREIA. VII+ 101 p. Breslau, MARCUS, 1929. ISIS

Reviewed by FRITZ HEICHELHEIM, *OLZ*, 34, 232, 1931.

Goodenough, Erwin R. The jurisprudence of the Jewish courts in

Egypt. Legal administration by the Jews under the early Roman Empire as described by PHILO JUDAEUS. IX+268 p. New Haven, Yale University Press, 1929. ISIS

Reviewed by S. KRAUSS, *OLZ*, 34, 451-53, 1931.

Goodspeed, Edgar Johnson. Strange new gospels. XI+111 p. University of Chicago Press, 1931. ISIS

Lösch, Stephan. Epistula Claudiana. Der neuentdeckte Brief des Kaisers CLAUDIUS vom Jahre 41 n. Chr. und das Ur-Christentum. Eine exegetisch-historische Untersuchung. 48 p. Rottenburg am Neckar, BADER, 1930. ISIS

Reviewed by E. BICKERMANN, *DLZ*, 2, 320-22, 1931.

Ist Century (second half)

Darmstaedter, Ernst. Ein Vorläufer der modernen Quarzlampen im Altertum. *Chem.-Ztg.*, 55, 204, 1931. ISIS

Draguet, R. Le Juif JOSÈPHE, témoin du Christ? A propos du livre de R. EISLER. *Revue d'histoire ecclésiastique*, 26, 833-79, 1931. ISIS

Freundorfer, Joseph. Die Apokalypse des Apostels JOHANNES und die hellenistische Kosmologie und Astrologie. Eine Auseinandersetzung mit den Hauptergebnissen der Untersuchung FRANZ BOLLS: "Aus der Offenbarung Johannis." XV+148 p. (*Biblische Studien.* Begr. v. O. BARDENHEWER. Fortgef. v. JOH. GÖTTSBERGER u. JOS. SICKENBERGER. Bd. 23, H. 1.) Freiburg, i. Br., HERDER, 1929. ISIS

Reviewed by W. GUNDEL, *DLZ*, 2, 481-84, 1931; by E. ZINNER, *Vierteljahrsschrift der Astronomischen Gesellschaft*, 66, 13, 1931.

Glendinning, H. PLINY's water-mill. *Nature*, 127, 974, 1 fig., 1931. ISIS

Goldschmidt, Felix. Ein Vorläufer der modernen Quarzlampen im Altertum. *Chem.-Ztg.*, 55, 19, 1931. ISIS

Kantorowicz, E. Der Tod des PLINIUS. *Ther. Ber.*, 8, 52-56, 1931. ISIS

Thackeray, H. St. John. JOSEPHUS the man and the historian. IX+160 p. New York, Jewish Institute of Religion, 1929. ISIS

Reviewed by NORMAN BENTWICH, *Jewish Quarterly Review*, 22, 43-47, 1931.

Vogels, Henr. Jos. Codicum Novi Testamenti specimina. Paginas 51 ex codicibus manuscriptis et 3 ex libris impressis collegit ac phototypice repraesentatas edidit. 13 p., 54 pl. Bonn, Hanstein, 1929. ISIS

Reviewed by Ernst Lohmeyer, *OLZ*, 34, 549, 1931.

Vowles, Hugh P. Pliny's water-mill. *Nature*, 127, 889, 1 fig., 1931. ISIS

Apropos of the pestle-and-mortar water-mill mentioned in the Natural history (XVIII, 23) with reference to a water-mill of that kind existing in Kashgar, Turkastan (photograph).

G. S.

Zeitlin, Solomon. Josephus on Jesus. *Jewish Quarterly Review*, 21, 377-417, 1931. ISIS

IInd Century (whole and first half)

Davis, Tenney L.; Wu, Lu-Ch'iang. The advice of Wei Po-yang to the worker in alchemy. *The Nucleus*, 2 p., March 1931. ISIS

" Wei Po-yang was ' the father of alchemy ' and his *Ts'an T'ung Ch'i* (Akinness of the Trio), written about 142 A.D., is regarded as the earliest work in the Chinese language which is devoted exclusively to the subject of alchemy. It purports to be a commentary on the Book of Change but is really an account of the preparation of the pill of immortality from cinnabar. It mentions several earlier workers in the art, contains abundant evidence of a well-established alchemical tradition, and shows that its author was actuated by motives and principles closely similar to those which moved the later and better known Greek, Arab, and Latin European alchemists."

The authors are preparing a complete English translation of the *Ts'an t'ung ch'i* and quote many extracts from it.

G. S.

Davis, Tenney L.; Wu, Lu-Ch'iang. The pill of immortality. A translation from the Chinese of the earliest known treatise on alchemy reveals some second-century miracles. *Technology Review*, 383-85, 418, 5 fig., May, 1931. ISIS

" Later Chinese alchemists refer to Wei Po-yang as the ' Father of alchemy ' and regard his *Ts'an T'ung Ch'i* (Akinness of the Trio) as the earliest treatise in the Chinese language which is devoted exclusively to the subject of alchemy. Although it was written in the first half of the second century, about 142 A.D., it is by no means the earliest Chinese writing which makes mention of alchemy. It shows that an extended and definite alchemical tradition already existed, and makes mention of several earlier alchemists concerning whom other information is avaiable either from their own writings or from the historical books." Analysis of that Chinese treatise with long extracts in English.

G. S.

Hennig, R. Ostasien bei PTOLEMÄUS. *Geographische Zeitschr.* 36, 257-73, 1930. ISIS

Herrmann, Albert. MARINUS VON TYRUS. *Petermanns Mitteilungen*, Ergänzungsheft Nr. 209, 45-54, 1930. ISIS

Honigmann. MARINOS VON TYROS, Geograph und Kartograph. *Paulys Real-Encyclopädie der classischen Altertumswissenschaft.* Neue Bearb., 28, 1767-96, 1930. ISIS

Ilberg, Johannes. RUFUS VON EPHESOS. Ein griechischer Arzt in trajanischer Zeit. 53 p. (*Abh. d. Sächs. Akad. d. Wiss.*, Philol.-hist. Kl., Bd. XLI, Nr. 1). Leipzig, HIRZEL, 1930. ISIS

Reviewed by JOHANNES MEWALDT, *DLZ*, 2, 538-40, 1931.

Johnston, E. H. The Saundarananda of AŚVAGHOṢA (critically edited with notes); XI+171 p. (*Penjab University Oriental Publications*). London, MILFORD, 1928. ISIS

Reviewed by MARCELLE LALOU, *Journal asiatique*, 217, 174, 1930.

IInd Century (second half)

Bilancioni, Guglielmo. GALENO. L'enciclopedico della medicina e della biologia. 136 p. Milan, AGNELLI, 1930. ISIS

Burr, Charles W. GALEN. *Annals of Medical History*, 3, 209-17, 1931. ISIS

Walsh, Joseph. Refutation of the charges of cowardice made against GALEN. *Annals of Medical History*, 3, 195-208, 4 figs., 1931. ISIS

Williams, A. Lukyn. JUSTIN martyr. The dialogue with TRYPHO. Translation, introduction and notes. XLII+301 p. (*Translations of Christian literature*, series I., Greek texts.) London, S. P. C. K., 1931. ISIS

IIIrd Century (whole and first half)

Hope, Richard. The book of DIOGENES LAËRTIUS. Its spirit and its method. XIV+241 p. New York, Columbia Univ. Press, 1930. ISIS

Reviewed by K. v. FRITZ, *DLZ*, 2, 598-601, 1931.

Irsay, Stephen d'. Christian medicine and science in the third century. *J. of Religion*, 10, 515-44, 1930. ISIS

IVth Century (whole and first half)

Baker, G. P. CONSTANTINE THE GREAT and the Christian revolution. XI+351 p. London, NASH and GRAYSON, 1931. ISIS

IVth Century (second half)

Barbagallo, Corrado. JULIANUS. (Estratto dal *Dizionario epigrafico di antichità romane*, di ETTORE DE RUGGIERO, vol. IV, 173-209). Spoleto, 1930. ISIS

Reviewed by A. P., *Journal des Savants*, 132, 1931.

Bidez, Joseph. La tradition manuscrite et les éditions des discours de l'Empereur JULIEN. X+154 p. (*Université de Gand, Recueil de Travaux publiés par la Faculté de Philosophie et lettres*, 61e fascicule). Gand, VAN RYSSELBERGHE et ROMBAUT, 1929. ISIS

Reviewed by HENRI GRÉGOIRE, *Byzantion*, 5, 730-36, 1930.

(**Oribasius**). Collectionum medicarum reliquiae. Vol. 3, Libri XXIV-XXV, XLIII-XLVIII. Ed. JOHANNES RAEDER. VIII+291 p. (*Corp. med. Graec.* VI, 2, 1). Leipzig, TEUBNER, 1931. ISIS

Simpson, W. Douglas. JULIAN THE APOSTATE. XI+126 p. Aberdeen, MILNE and HUTCHISON, 1930. ISIS

Reviewed by F. A. CHRISTIE, *American Historical Review*, 573-74, 1931.

Temkin, Owsei. Das "Brüderpaar" PHILAGRIOS und POSEIDONIOS. *Archiv f. Geschichte der Medizin*, 24, 268-70, 1931. ISIS

"Mag auch für die Zeit zwischen dem Terminus post quem (GALEN) und dem Terminus ante quem (ORIBASIUS) kein ganz sicherer Fixpunkt gefunden sein, so scheint doch eines festzustehen : Die Ärzte PHILAGRIOS und POSEIDONIOS waren keine Brüder, der erstere wirkte bereits vor 360, der letztere erst gegen Ende des 4. Jahrhunderts."

Vth Century (whole and first half)

Blondel, Maurice. Pour le quinzième centenaire de la mort de ST. AUGUSTIN. L'unité originale de sa doctrine philosophique. *Revue de métaphysique et de morale*, 37, 423-69, 1930. ISIS

Duckett, Eleanor Shipley. Latin writers of the fifth century. With an introduction by ERIC MILNER-WHITE. XVIII+271 p. New York, 1931. ISIS

Salvianus Massiliensis, St. On the government of God ; a treatise

wherein are shown by argument and by examples drawn from the abandoned society of the times the ways of God toward His creatures, indited by SALVIAN, presbyter of Marseilles and master of bishops, as a warning and counsel. This fifth century polemic done into English by EVA M. SANFORD. VIII+241 p., pl. New York, Columbia University Press, 1930. ISIS

Schaefer, Andreas. Römer und Germanen bei SALVIAN. XII+104 p. Breslau, BORGMEYER, 1930. ISIS

Reviewed by CARL WEYMAN, *DLZ*, 2, 784-86, 1931.

Tin, Pe Maung. The path of purity. Being a translation of BUDDHAGHOSA's Visuddhimagga. Part III. Of understanding. With an epilogue by Mrs. RHYS DAVIDS. VIII+p. 505-907. Oxford, University Press, 1931. ISIS

Vth Century (second half)

(Āryabhaṭa). The Āryabhaṭīya of ĀRYABHAṬA. An ancient Indian work on mathematics and astronomy. Translated with notes by WALTER EUGENE CLARK. XXX+90 p. Chicago, University Press, 1930. ISIS

Reviewed by G. SARTON, *Isis*, 15, 173-74, 1931.

Āryabhaṭa (*Introduction*, I, 409). It is perhaps too much to say that he found the general solution of indeterminate equations, etc., but he was apparently working on this problem. The sign $\pm$ in the first formula should be replaced by $+$. In the second formula, insert d after $\frac{n-1}{2} + p)$. R. C. A. ISIS

Devresse, R. DENIS L'ARÉOPAGITE et SÉVÈRE D'ANTIOCHE. *Arch. d'histoire doctrin. et littér. du Moyen Age*, 159-68, 1930. ISIS

L'auteur discute, puis rejette l'opinion émise par le R. P. STIGLMAYER, suivant laquelle l'auteur qui se cache sous le pseudonyme de DENYS L'ARÉOPAGITE ne serait autre que SÉVÈRE D'ANTIOCHE. « Avant la moitié du V^e^ siècle, DENYS était mis en circulation, SÉVÈRE n'était pas né. »

L. G.

Sengupta, Probodhchandra. "ARYABHATA's lost work." *Bull. Calcutta Math. Soc.*, 22, 115-20, 1930. ISIS

"It seems now clear that the essentials of the lost work of ARYABHATA are to be found from the Khandakhadyaka of BRAHMAGUPTA. So candid is the author that he either states directly or it may be easily inferred, where he differs from ARYABHATA."

Uhden, Richard. Die Weltkarte des MARTIANUS CAPELLA. *Petermanns Mitteilungen*, 76, 126, 1930. ISIS

VIth Century (whole and first half)

Casanowicz, I. M. A colored drawing of the Medeba mosaic map of Palestine in the United States National Museum. *Proceedings of the United States National Museum*, 49, 359-76, 1915. ISIS

Johannes Philoponus. Opuscula monophysitica. Syriace edidit et latine interpretatus est A. SANDA. 132 p. Beirut, Imp. Catholique, 1930. ISIS

Reviewed by J. B. CHABOT, *Journal des Savants*, 177-79, 1931.

Severus. Philalethes. Syriace edidit et latine interpretatus est A. SANDA. P. 115-17. Beirut, Imp. Catholique, 1928. ISIS

Reviewed by J. B. CHABOT, *Journal des Savants*, 177-79, 1931.

Thomsen, Peter. Das Stadtbild Jerusalems auf der Mosaikkarte von Medeba. *Zeitschrift des deutschen Palästina-Vereins*, 52, 149-74, pl., 1929. ISIS

Vyver, A. van de. CASSIODORE et son œuvre. *Speculum*, 6, 244-92, 1931. ISIS

VIIth Century (whole and first half)

Bergsträsser, Gotthelf. Plan eines Apparatus Criticus zum Koran. 11 p. (*Sitzungsberichte d. Bayer. Akad. d. Wiss.*, Philos.-hist. Abt., Jg. 1930, H. 7.) München, OLDENBOURG, 1930. ISIS

Reviewed by GOTTHOLD WEIL, *DLZ*, 2, 1111-13, 1931.

Pickthall, Marmaduke. The meaning of the glorious Koran. An explanatory translation. VIII+693 p. London, KNOPF, 1931. ISIS

Sofer, Johann. Lateinisches und Romanisches aus den Etymologiae des ISIDORUS VON SEVILLA. XII+189 p. (Gedruckt mit Unterstützung der Akademie der Wissenschaften in Wien). Göttingen, VANDENHOECK u. RUPRECHT, 1930. ISIS

Reviewed by URBAN T. HOLMES, *Speculum*, 6, 492-94, 1931.

VIIth Century (second half)

Dold, Alban. Donaueschinger Fragmente eines mehrere Bücher

umfassenden medizinischen Rezeptars (in Unzialschrift des 7./8. Jahrhunderts). *Archiv für Geschichte der Medizin*, 24, 205-19, 1 fig., 1931. ISIS

Dieses Donaueschinger Rezeptarfragment bildet "ein wertvolles Stück alter medizinischer Literatur, und dies in mehrfacher Hinsicht. Hat man die Mühe nicht gescheut, den Sinn der entstellten Rezepte festzustellen, so wird ohne weiteres klar, dass wir es hier keineswegs mit einer von irgendeiner obskuren Persönlichkeit besorgten Zusammenstellung volksmedizinischer Mittel zu tun haben, wie sie das Mittelalter zu bieten liebte, sondern dass hier uraltes, auf griechische Überlieferung zurückgehendes Gut vorliegt, das fachärztliches Wissen zusammengetragen hat. In keinem der uns erhaltenen Rezepte finden wir — ausgenommen vielleicht die freilich für eine innere Anwendung wenig einladende Schusterschwärze — irgend ein Mittel zweifelhafter oder obszoener Herkunft. Diese zutage tretende sachliche und sorgsame Wahl der Mittel wird um so verständlicher, wenn wir im Text des 85. Rezeptes die Worte lesen : ' Quemadmodum autem eo (scl. emplastro) uti debeas uel quibus passionibus superiori libro idest in secundo euidenter ostensum est ' (siehe Pag. 8 der Texte, Zeile 2-4). Wir haben also auf unseren Blättern nicht etwa die Fragmente irgendeines Exscarpsus aus älteren medizinischen Werken vor uns, sondern eines dieser verlorengegangenen Werke selbst, ja sogar eines solchen, das einst zum mindesten drei Bücher umfasst hat." Text with glossary and facsimile of a page.

G. S.

Englert, Ludwig. Die medizinhistorische Bedeutung des Fragmentum Donaueschingense. *Archiv. f. Geschichte der Medizin*, 24, 220-44, 1931. ISIS

"Mit der Entdeckung des vorliegenden Fragmentes ist Pater ALBAN DOLD ein medizinhistorisch ausserordentlich bedeutsamer Fund beschieden gewesen. Denn dieses Fragment stellt in der Reihe der bis jetzt bekannten frühmittelalterlichen Rezeptarien etwas völlig Neues und Einzigartiges dar. Es ist bis jetzt noch bei keinem dieser Rezeptarien gelungen, direkte Beziehungen zu der grossen pharmakologischen Literatur der Antike nachzuweisen. Bei dem Fragmentum Donaueschingense ergeben sich zum erstenmal solche Beziehungen in übewältigender Fülle, und zwar zu den pharmakologischen Schriften des GALEN." "Liesse sich eine unmittelbare Beziehung zu GALEN nachweisen, so wäre damit ebenfalls ein Novum in der Geschichte der Medizin gegeben, da wir bis jetzt keine frühmittelalterliche Übersetzung aus GALEN kennen. Heute können wir prinzipiell nur sagen, dass in unserem Fragment die lateinische Übersetzung eines griechischen Vorbildes vorliegt. Die Vermutung von Pater ALBAN DOLD, dass wir in unseren Blättern nicht etwa die Fragmente irgendeines Excarpsus aus älteren medizinischen Werken vor uns haben, kann ich nicht teilen. Auch seiner Annahme, dass das vorliegende Fragment zum mindesten drei Bücher umfasst hat, stehe ich mit den grössten Bedenken gegenüber. Denn der Passus ' superiori libro id est in secundo evidenter ostensum est,' findet sich in jener Partie, die unter der Überschrift de emplastris geht, und die, wie ich in der Analyse ausführe, eine spätere Zutat, die nichts mit der Anfangspartie unseres Fragmentes zu tun hat, darstellt. Das ursprüngliche Rezeptar hat nach meiner

Meinung nicht mehr als die Rezepte 1-84 umfasst, und bildete in sich eine geschlossene Einheit."

(Jacob of Edessa). JACOBI EDESSENI Hexaemeron seu in opus Creationis libri septem, edidit I. B. CHABOT. VI+398 p. Paris, 1928. ISIS

Reviewed by FRANÇOIS NAU, *Journal asiatique*, 217, 127-30, 1930.

VIIIth Century (second half)

Kraus, Paul. Studien zu JĀBIR IBN ḤAYYĀN. *Isis*, 15, 7-30, 1931. ISIS

IXth Century (whole and first half)

'Alī al-Tabarī (*Introduction*, I, 574). This note should be entirely rewritten with reference to MAX MEYERHOF: 'ALĪ AL-ṬABARĪ's Paradise of wisdom, one of the oldest compendiums of medicine (*Isis*, 16, 6-54, 1931). ISIS

Macartney, C. A. The Magyars in the ninth century. VIII+242 p., map. Cambridge, University Press, 1931. ISIS

IXth Century (second half).

Codazzi, Angela. Il compendio geografico arabo di ISHAQ IBN AL-HUSAYN. *Rendiconti della r. Accademia nazionale dei Lincei*; classe di scienze morali, storiche e filologiche, 5, 373-463, 1929. ISIS

Ferrand, Gabriel. Voyage du marchand arabe SULAYMĀN en Inde et en Chine. 157 p. (*Les classiques de l'Orient*, t. 7) Paris, BOSSARD, 1922. ISIS

Reviewed by HENRI BASSET, *Hespéris*, 2, 495-96, 1922.

Hübener, Gustav. Kœnig ALFRED's Geografie. *Speculum*, 6, 428-34, 1931. ISIS

Menetrier, M. P. Le millénaire de RAZÈS. La médecine arabe, son rôle dans l'histoire et son influence sur la médecine française. *Bulletin de la société française d'histoire de la médecine*, 25, 191-202, 1931. ISIS

Renaud, H. P. J. A propos du millénaire de RAZÈS. *Bulletin de la société française d'histoire de la médecine*, 25, 203-07, 1931. ISIS

Yaḥyā ibn Sarāfyūn (*Introduction*, I, 608). He was already called

JOHANNES DAMASCENUS by ROGER BACON in *De erroribus medicorum*. In another place of the same work, BACON also calls him SERAPIO.
M. C. W. ISIS

Xth Century (whole and first half)

Carton, Raoul. Déchéance et survie au X^e^ siècle du renouveau carolingien. *Revue de philosophie*, 1, 157-75, 1930. ISIS

Mžik, Hans von. Bibliothek arabischer Historiker und Geographen. V. Band : Das Kitāb 'ajā'ib al-Aqālīm as-Sab'a des SUHRĀB. Hrsg. nach dem handschriftl. Unikum des Britischen Museums in London (Cod. 23379 Add.). Arabischer Text. XVII+201 p. Leipzig, HARRASSOWITZ, 1930. ISIS

Reviewed by GABRIEL FERRAND, *Journal asiatique*, 217, 161-62, 1930; by ERNST HONIGMANN, *OLZ*, 34, 456-59, 1931. This SUHRĀB, whoever he was, is identical with the author called erroneously IBN SERAPION by GUY LE STRANGE and others. See my *Introduction*, I, 635, and *Isis*, 14, 472.
G. S.

Xth Century (second half)

Adler, Ada. SUIDAE Lexicon. Pars 1. XXX+549 p. (*Lexicographi graeci recogniti et apparatu critico instructi*. Volumen 1). Leipzig, TEUBNER, 1928. ISIS

Reviewed by MAX SULZBERGER, *Byzantion*, 5, 701-04, 1930.

Greene, Henry Copley. GERBERT, man of science, c. 945-1003. Fact and the legend. 8 p. History Reference Council (Civilization, science, letters, arts.) 14 Kirkland Place, Cambridge, Mass., 1931. ISIS

Strecker, Karl. Hrotsvithae opera denuo edidit, Codicis Coloniensis lectionem primum adiecit. XII+278 p. Leipzig, TEUBNER, 1930. ISIS

Reviewed by GOSWIN FRENKEN, *DLZ*, 2, 1165-68, 1931.

XIth Century (whole and first half)

Nāzim, Muḥammad. The life and times of sulṭān MAḤMŪD OF GHAZNA (998-1030). With a foreword by Sir THOMAS ARNOLD. XVI+272 p. Cambridge, University Press, 1931. ISIS

XIth Century (second half)

Blanchère, R. L. Une source de l'histoire des sciences chez les Arabes :

Les Ṭabakāt al-Umam de Ṣā'id al-Andalusī. *Hespéris*, vol. 8, 557-61, 1928. ISIS

For this 'Ṣāid al-Andalusi, see Sarton's *Introduction* (vol. 1, 776). The author concludes : " Comme l'on voit, il est peu d'ouvrages fondamentaux qui aient connu l'honneur du plagiat aussi complètement que le mince opuscule de Ṣā'id. Et ceci va naturellement nous amener à faire quelques restrictions sur la valeur même des trois compilations que nous venons de passer rapidement en revue. Non seulement ce sont des ouvrages de seconde main, mais une de leurs sources principales, les Ṭabakāt, n'est qu'une compilation dont le contenu, nous l'avons dit, est de valeur inégale et sujette à caution. Tout n'y est pas assurément faux, mais tout y est douteux et la plus élémentaire prudence veut que l'on ne se serve des Ṭabakāt et des compilations qui en sont issues, qu'avec beaucoup de circonspection. Notre défiance devra même aller plus loin et s'étendre jusqu'aux ouvrages européens relatifs aux sciences chez les Arabes, qui s'appuieront uniquement sur Ibn al-Ḳifṭi et Ibn Abī Uṣaibi'a. C'est ainsi que les notices sur des médecins secondaires, tirées par Leclerc de ces deux compilateurs, sont loin de contenir des renseignements aussi sûrs qu'on pouvait le croire à cette époque."

Darmesteter, Arsène ; Blondheim, D. S. Les gloses françaises dans les commentaires talmudiques de Raschi. Tome 1 : Texte des gloses. LXXVI+212 p. (*Bibliothèque de l'école des hautes études*. Sciences historiques et philologiques, 254). Paris, Champion, 1929. ISIS

Reviewed by E. Gamillscheg, *OLZ*, 34, 238-40, 1931; by I. Elbogen, *DLZ*, 2, 390-91, 1931.

Lehmann, Hermann. Die Arbeitsweise des Constantinus Africanus und des Johannes Afflacius im Verhältnis zueinander. *Archeion*, 12, 272-81, 1930. ISIS

Comparaison entre les antidotaires de Constantinus Africanus, Johannes Afflacius, et d'une manière générale, les antidotaires salernitains et Arabes ('Alī ibn al'Abbās, Ibn al Djazzār).

L. G.

Lehmann, Hermann. Zu Constantinus Africanus. *Archiv f. Geschichte der Medizin*, 24, 263-68, 1931. ISIS

Litten, Wilhelm. Was bedeutet Chäjjam? Warum hat Omar Chäjjam, der Verfasser der berühmten persischen Vierzeiler, gerade diesen Dichternamen gewählt? Versuch einer Erklärung. 25 p. Berlin, de Gruyter, 1930. ISIS

Reviewed by Arthur Christensen, *OLZ*, 34, 564-65, 1931.

'Omar-i-Khayyam. The quatrains of 'Omar-i-Khayyam. Persian text taken from two newly discovered oldest manuscripts with an

English prose version by FRIEDERICH ROSEN. VI+200+17+197 p., 4 pl. London, LUZAC, 1931. ISIS

Reviewed by C. N. S., *Journal of the Royal Asiatic Society*, 457-59, 1931.

Rodwell, E. H. OMAR KHAYYAM. The Persian text, with paraphrase and the first and fourth edition of FITZGERALD's translation. London, KEGAN PAUL, 1931. ISIS

XIIth Century (whole and first half)

Alarcón, Maximiliano. Lámpara de los príncipes por ABUBÉQUER DE TORTOSA. Traducción española. 2 vols. vol. 1, LXIII+437 p.; vol. 2, 546 p. Madrid, Instituto de Valencia de Don Juan, 1930-1931. ISIS

I much regret that these two volumes reached me just too late to be mentioned in vol. 2 of my *Introduction* (p. 264). They contain a Spanish translation (as far as I know the first European translation) of the Sirâj al-mulûk of ABÛ BAKR MUḤAMMAD IBN AL-WALÎD AL-ṬURṬUSHÎ. The Sirâj al-mulûk is a treatise on practical politics wherein the author's arguments are illustrated by means of a great many historical anecdotes. The translation is preceded by an introduction (63 p.) including the usual bio- and bibliographical data, plus an analysis of the book chapter by chapter; it is followed by a very elaborate index of proper names (p. 459-546) which is in fact a brief biographical dictionary. All of which shows that the scholarly work of the Spanish mediaevalists continues in spite of political turmoil.

G. S.

Datta, Bibhutibhusan. The two BHĀSKARAS. *Indian Historical Quarterly*, 6, 727-36, 1930. ISIS

"It is well-known that there was one ancient Hindu astronomer and mathematician of the name of BHĀSKARA, who was the celebrated author of *Līlāvatī*, *Bījagaṇita* and *Siddhānta-śiromaṇi*. He is more commonly known as BHĀSKARĀCĀRYA." "I shall presently show that there was another Hindu astronomer of the same name, BHĀSKARA, who was anterior to the author of the *Siddhānta-śiromaṇi* by several centuries."

Munqidh, Usāmah ibn. USĀMAH's memoirs entitled *Kitāb al-I'tibār*. Arabic text edited from the unique manuscript in the Escurial Library, Spain, by PHILIP K. HITTI. XLIII+240 p., 1 pl. (*Princeton Oriental Texts*, vol. 1). Princeton, University Press, 1930. ISIS

Reviewed by WILLIAM THOMSON, *Isis*, 15, 341-42, 1931.

Nerman, Birger. The poetic edda in the light of archaeology. VII+94 p. Coventry, CURTIS and BEAMISH, 1931. ISIS

Renaud, H. P. J. Trois études d'histoire de la médecine arabe en Occident. I. Le *Musta'înî* d'IBN BEKLĀREŠ. *Hespéris*, vol. 10, 135-50, facs., 1930. ISIS

« Une des sources les plus remarquables auxquelles ont puisé des philologues comme DOZY pour la rédaction de son *Supplément aux dictionnaires arabes*, ouvrage estimé qui vient d'être réédité, et SIMONET, pour son *Glossaire des mots ibériques et latins usités par les Mozarabes*, est le *Musta'înî fi't-ṭibb* d'IBN BEKLĀREŠ. C'est un traité de matière médicale, disposé en forme de tableaux synoptiques, et dont le titre rappelle le nom du prince AL-MUSTA'IN BILLĀH (celui qui demande l'aide de Dieu), auquel il fut dédié. Quant à l'auteur, c'est un médecin juif de l'Espagne musulmane, YŪSUF (ou mieux YŪNUS) B. ISḤĀḲ IBN BEKLĀREŠ. » (Voir SARTON : *Introduction*, vol. 2, 235).

Scalinci, Noè. Chi è il « MAGISTER NICOLAUS » citato nel' *Ars probata oculorum* di BENVENUTO GRAFEO (Jerosolimitano)? (Incunabulo di Ferrara). *Boll. Ist. stor. Ital. arte sanit.*, 10, 267-70, 1930. ISIS

Answer : NICOLAUS DA REGGIO.

Scalinci, Noè. L'oculista medioevale m° ZACCARIA e le fonti della sua « Sisilacera ». *Rivista di storia delle scienze mediche e naturali*, 22, 8-21, 1931. ISIS

Shahrastani, al. The Summa philosophiae of AL-SHAHRASTANI. Kitabu Nihayati 'l Iqdam fi 'lmi 'l Kalam. Edited from manuscripts in the Libraries of Oxford, Paris and Berlin by ALFRED GUILLAUME. Part 1. Oxford, University Press, 1931. ISIS

Tatlock, John S. P. Certain contemporaneous matters in GEOFFREY OF MONMOUTH. *Speculum*, 6, 206-24, 1931. ISIS

Trautmann, Reinhold. Die altrussische Nestorchronik Povest' Vremennych Let. In Übersetzung hrsg. v. REINHOLD TRAUTMANN. XXII+304 p. (*Sächs. Forschungsinst. in Leipzig. Forschungsinst. f. Indogermanistik*, slav. Abt., Slav.-balt. Quellen u. Forschgn. H. VI.) Leipzig, MARKERT & PETTERS, 1931. ISIS

Reviewed by A. BRÜCKNER, *DLZ*, 2, 234-37, 1931.

XIIth Century (second half)

Balzli, Hans. Vokabularien im Codex Salernitanus der Breslauer Stadtbibliothek (Nr. 1302) und in einer Münchener Handschrift (Lat. 4622), beide aus dem XII. Jahrhundert. VI+64 p. Leipzig, BARTH, 1931. ISIS

Bett, Henry. JOACHIM OF FLORA. VII+184 p. London, METHUEN, 1931. ISIS

Cohen, Harry. The commentary of Rabbi DAVID KIMHI on HOSEA, ed. with critical notes showing his sources, on the basis of manuscripts and early editions. XLI+130 p. (*Columbia University Oriental Studies*, XX). New York, Columbia University Press, 1929. ISIS

Reviewed by R. EDELMANN, *OLZ*, 34, 546-47, 1931.

Joseph ben Meir ben Sabara. Llibre d'ensenyaments delectables. Catalan translation by IGNACIO GONZALEZ LLUBERA. Barcelona, Editorial Alpha, 1931. ISIS

Nerses von Lampron. Erklärung des Versammlers (Predigers); hrsg. und übs. von Dr. MAX, Herzog zu Sachsen. IV+188 p. Leipzig, HARRASSOWITZ, 1929. ISIS

Reviewed by K. MLAKER, *OLZ*, 34, 366-69, 1931.

Williams, John R. The authorship of the *Moralium dogma philosophorum*. *Speculum*, 6, 392-411, 1931. ISIS

"In view of the doubtful character of this evidence is it possible to accept without qualification either WILLIAM OF CONCHES or WALTER OF CHÂTILLON as the author of the *Moralium Dogma Philosophorum?* The arguments in favor of the one seem to be nearly exactly balanced by those in favor of the other. While WILLIAM's authorship is supported by a number of external sources, WALTER's lacks such corroboration. On the other hand, the references contained in the letter of dedication, though applicable to WILLIAM's relations with HENRY PLANTAGENET, fit with greater precision the vicissitudes of the career of WALTER's patron, HENRY OF FRANCE."

Wolfson, Harry A. Plan for the publication of a *Corpus Commentariorum Averrois in Aristotelem* submitted to the Mediaeval Academy of America. *Speculum*, 6, 412-27, 1931. ISIS

XIIIth Century (whole and first half)

Ch'ang-Ch'un. The travels of an alchemist: the journey of the Taoist CH'ANG-CH'UN from China to the Hindukush at the summons of CHINGIZ KHAN. Recorded by his disciple, LI CHIH-CH'ANG. Translated with an introduction by ARTHUR WALEY. XI+166 p. *(Broadway Travellers.)* London, ROUTLEDGE, 1931. ISIS

Drescher, Karl. JOHANN HARTLIEBS Übersetzung des *Dialogus Miraculorum* von CAESARIUS VON HEISTERBACH. Aus der einzigen Londoner Handschrift. XXIII+475 p., 2 pl. (*Dtsche. Texte d. Mittelalters.* Hrsg. v. d. Preuss. Akad. d. Wiss. Bd. XXXIII.) Berlin, WEIDMANN, 1929. ISIS

Reviewed by F. RANKE, *DLZ*, 2, 256-59, 1931.

Foulet, Alfred. Le couronnement de Renard. Poème du treizième siècle publié par ALFRED FOULET. LXXVIII+125 p. (Elliott monographs in the Romance languages and literatures. Vol. 24). Princeton, University Press, 1929. ISIS

Reviewed by ALFRED SCHULZE, *DLZ*, 2, 354-55, 1931.

Lângfors, Arthur. Histoire de l'abbaye de Fécamp en vers français du XIII[e] siècle, publiée avec une introduction et un glossaire. 282 p. (*Annales Academiae Scientiarum Fennicae*, ser. B, tom. XXII, 1.). Helsingfors, Société de Littér. Finnoise, 1928. ISIS

Reviewed by WALTHER SUCHIER, *DLZ*, 1, 635-37, 1930.

Sabatier, Paul. Vie de S. FRANÇOIS D'ASSISE. Edition définitive. Paris, FISCHBACHER, 1931. ISIS

Tanner, J. R.; Previté-Orton, C. W.; Brooke, Z. N. The Cambridge Mediaeval History. Planned by J. B. BURY. Volume 6. Victory of the papacy. XLI+1047 p. Cambridge University Press, 1929. ISIS

Reviewed by JAMES WESTFALL THOMPSON, *Speculum*, 6, 300-03, 1931.

XIIIth Century (second half)

Barhébréus. BARHEBRAEI carmina. 199 p. Jérusalem, Imprimerie du couvent syrien de S. Marc, 1929. ISIS

Reviewed by J. B. CH., *Journal des Savants*, 137, 1931.

Charignon, A. J. H. Le grande Java de MARCO POLO en Cochinchine. Etude de géographie historique d'après les sources chinoises et arabes. *Bulletin de la Société des études indochinoises*, 4, 193-347, 1930. ISIS

Laurent, V. Les manuscrits de l'histoire byzantine de GEORGES PACHYMÈRE. *Byzantion*, 5, 129-205, 1930. ISIS

Liertz, Rhaban. Der selige ALBERT DER GROSSE als Naturforscher und Lehrer. 62 p., 1 port. München, Salesianer-Verl., 1931. ISIS

Loffin, D. O. L'authenticité de *De potentiis animae* d'ALBERT LE GRAND. *Revue néo-scholastique de Philosophie*, 3, 321-38, 1930. ISIS

L'auteur de *De potentiis animae* ne peut pas être ALBERT LE GRAND.

Manly, John Matthews. ROGER BACON and the Voynich MS. *Speculum*, 6, 345-91, 5 pl., 1931. ISIS

Penzer, N. M. The most noble and famous travels of MARCO POLO, together with the travels of NICHOLÒ DE' CONTI. Edited from the Elizabethan translation of JOHN FRAMPTON, by N. M. PENZER. LX+381 p., 2 pl., 11 maps. London, Argonaut Press, 1929. ISIS

Reviewed by W. E. SOOTHILL, *Journal of the Royal Asiatic Society*, 455-57, 1931.

(Polo, Marco). The book of Ser MARCO POLO the Venetian. Concerning the kingdoms and marvels of the East. Edited with an introduction by GEORGE B. PARKS. XXXII+392 p., 2 maps. *(The Modern Readers' Series)*. New York, MACMILLAN, 1927. ISIS

Reviewed by ALBERT HERRMANN, *OLZ*, 34, 613, 1931.

Rūmī, Falāl-ud-Dīn. Tables of mystic meaning. Being selections from the *Mathnawī* of FALĀL-UD-DĪN RŪMĪ. Translated with an introduction by R. A. NICHOLSON, with a frontispiece by CYNTHIA KENT. XVIII+171 p. London, CHAPMAN and HALL, 1931. ISIS

Schmarsow, August. Italienische Kunst im Zeitalter DANTES. Mit Unterstütz. d. Notgemeinsch. d. dtsch. Wissensch. 1 Bd. Text, 1 Bd. Taf. 205 p., 158 pl. Augsburg, FILSER, 1928. ISIS

Reviewed by ARTHUR HASELOFF, *DLZ*, 2, 654-57, 1931.

Wulff, Winifred. On the qualitees, maners, and kunnynge of a surgean etc. *Z. f. Celtische Philologie*, 18, 249-86, 1930. ISIS

XIVth Century (whole and first half)

Cranc, Claus. Die Prophetenübersetzung des CLAUS CRANC. Hrsg. v. WALTHER ZIESEMER. VIII+415 p. (*Schrift. d. Königsberger Gelehrt. Gesellsch.* Sonderreihe, Bd. 1.) Halle a. S., NIEMEYER, 1930. ISIS

Reviewed by PH. STRAUCH, *DLZ*, 2, 983-85, 1931.

Ercole, Francesco. Il pensiero politico di DANTE. 2 vol. 367 p.; 407 p. Milan, ALPES, 1927-28. ISIS

Reviewed by HENRI HAUVETTE, *Journal des Savants*, 18-31, 66-79, 1931.

Kamil Ayad, M. Die Geschichts- und Gesellschaftslehre IBN KHALDŪNS. X+209 p. (*Forschgn. z. Geschichts- u. Gesellschaftslehre.* Hrsg. v. KURT BREYSIG. H. 2.) Stuttgart, COTTA, 1930. ISIS

Reviewed by R. STROTHMANN, *DLZ*, 2, 1237-39, 1931.

Mondino de' Liucci. Anatomia. Riprodotta da un codice Bolognese

del secolo XIV e volgarizzata nel secolo XV. Ed. by LINO SIGHINOLFI ; preface by GIACINTO VIOLA. VIII+197+LXXXIII p. Bologna, CAPPELLI, 1930. ISIS

Nardi, Bruno. Saggi di filosofia dantesca. XII+380 p. Milan, ALIGHIERI, 1930. ISIS

Reviewed by HENRI HAUVETTE, *Journal des Savants*, 18-31, 66-79, 1931.

Roncière, Ch. de la. Les portulans de la Bibliothèque de Lyon. 24 p. (*Documents paléographiques*, 8me fasc.) Lyon, 1929. ISIS

Reviewed by E. HEAWOOD, *Geographical Journal*, 76, 240-41, 1930. Two atlases are reproduced. The one by the Genoese, PIETRO VESCONTE, made at Venice probably about 1319; the other unsigned and undated, thought to have been drawn at Venice about the end of the fourteenth century.

C. W. A.

Valli, Luigi. Il linguaggio segreto di DANTE e dei Fedeli d'Amore. 142 p. Rome, Optima, 1928. ISIS

Reviewed by S. UDNY, *American Historical Review*, 36, 798-99, 1931.

(William of Ockham). The *De sacramento altaris* of WILLIAM OF OCKHAM. Edited by T. BRUCE BIRCH. XLII+275 p. Iowa, Lutheran Literary Board, 1931. ISIS

XIVth Century (second half)

Antuna, Melchor M. El poligrafo granádino ABENELJATIB en la Real Biblioteca del Escorial. Estudio bibliografico. 52+20 p. Real Monasterio del Escorial. (Extrait de la Revue des PP. Augustins de l'Escurial, *La Ciudad de Dios*), 1926. ISIS

Freitas, Jordão de. O descobrimento pre-colombino da America austral pelos portuguêses. *Revista do Instituto archeológico histórico e geográphico pernambucano*, 29, 259-71, 1928-1929. ISIS

Discussion of an unpublished document in the Archives of Torre do Tombo, which may indicate that the Portuguese had established a fort and trading station at Pernambuco as early as 1501 and that they possibly had built dwellings there in 1491.

J. K. W.

Halecki, Oskar. Un empereur de Byzance à Rome. 416 p. (*Travaux historiques de la Société des Sciences et des Lettres de Varsovie*, vol. 3, éd. de la Société scientifique de Varsovie). Varsovie, 1930. ISIS

Apropos of JOHN V PALAEOLOGOS, who visited Rome in 1369. Reviewed by HENRI GRÉGOIRE, *Byzantion*, 5, 767-79, 1930.

Ḫaṭīb Lisān ad-Dīn, Ibn al. Al-Lamḥat al-badrīya fī 'd-dawlat an-naṣrīya. Texte arabe publié par MUḤIBB AD-DIN AL ḪAṬĪB. 152 p. Le Caire, AS-SALAFIYA, 1347. ISIS

Reviewed by E. LÉVI-PROVENÇAL, *Hespéris*, 10, 133, 1930.

Osgood, Charles G. BOCCACCIO on poetry. Being the preface and the fourteenth and fifteenth books of BOCCACCIO's "Genealogia Deorum gentilium" in an English version with introductory essay and commentary. XLIX+214 p. Princeton, University Press, 1931. ISIS

Patch, Howard R. TROILUS on determinism. *Speculum*, 6, 225-43, 1931. ISIS

Reparaz, Gonçalo de, Jr. "Mestre Jacome de Malhorca," cartógrafo do Infante : contribuição para o estudo da origem da cartografia portuguesa. 55 p. Coimbra Editora, 1930. ISIS

The Portuguese chroniclers, DUARTE PACHECO and JOÃO DE BARROS, of the early 16th century, refer to a certain cartographer, Mestre JACOME OF MAJORCA, as having been called to Portugal by HENRY THE NAVIGATOR. He was doubtless instrumental in introducing Majorcan cartographic technique and in paving the way for the future development of Portuguese map making. The present study is a critical attempt to identify Mestre JACOME with the Jew JAFUDA CRESQUES, son of ABRAHAM CRESQUES. Both father and son were well known Majorcan cartographers.

J. K. W.

XVth Century (whole and first half)

Ailly, Pierre d'. *Ymago mundi*. Texte latin et traduction française des quatre traités cosmographiques d'AILLY, et des notes marginales de CHRISTOPHE COLOMB. Etude sur les sources de l'auteur par EDMOND BURON. 3 vol. 60 pl., portr. Paris, MAISONNEUVE, 1931. ISIS

Thorndike, Lynn. An unidentified work by GIOVANNI DA' FONTANA : "Liber de omnibus rebus naturalibus." *Isis*, 15, 31-46, 1931. ISIS

(Upton, Nicholas). The essential portions of NICHOLAS UPTON's "De studio militari." Before 1446. Translated by JOHN BLOUNT. Edited by FRANCIS PIERREPONT BARNARD. Oxford, Clarendon Press, 1931. ISIS

XVth Century (second half)

Barnard, Cyril C. The *De morbo quem Gallicum noncupant* (1497) of CORADINUS GILINUS. *Janus*, 34, 97-116, 1930. ISIS

Commentaire et traduction anglaise de ce petit traité sur la syphilis, v. *Isis*, 8, 353.

Caraci, Giuseppe. Una pretesa scoperta dell'America vent'anni innanzi COLOMBO. *Bollettino della R. Società geografica italiana*, 7, 771-812, 1930. ISIS

Colombo, D. Fernando. Le historie della vita e dei fatti di CRISTOFORO COLOMBO. Edited by RINALDO CADDEO. 2 vol. LXXXVII+316+380 p. Milan, Alpes, 1930. ISIS

Reviewed by C. J., *Geographical Journal*, 76, 576-78, 1930. The first critical edition of the "Historie" ever published.

C. W. A.

Columbus, Christopher. The voyages. Newly translated and edited with an introduction by CECIL JANE. 347 p. London, Argonaut Press, 1930. ISIS

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XVIth Century (whole and first half)

A. — *Mathematics*

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C. W. A.

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XVIth Century (second half)

A. — *Mathematics*

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Le mot logarithme est employé par CASPAR PEUCER dans *Commentarius de praecipuis divinationum generibus* (1553) à propos d'une relation entre les nombres triangulaires et les lettres de l'alphabet, relation qui représente une forme de divination. On est donc très loin de NAPIER. Il ne semble d'ailleurs pas possible de savoir si NAPIER a eu connaissance de l'ouvrage de PEUCER, assez répandu en Angleterre, et lui a emprunté le mot logarithme ou l'a inventé indépendamment. L. G.

Hairs, E. de. VALENTIN MENNHER. 8 p. *Wis- en natuurkundig Tijdschrift*, 5, 1930. ISIS

Communication faite au XXVI[e] Congrès des Sciences naturelles et médicales à Anvers, le 26 avril 1930. Né vers 1520 à Kempten en Bavière, VALENTIN MENNHER fut vers 1550 professeur d'arithmétique à Anvers où il était probablement attaché à la « Hanse » et mourut vers 1573. S'il ne fut pas un mathématicien de premier rang, il fut cependant un arithméticien habile et rendit de grands service à l'algèbre. DE HAIRS donne quelques extraits de l'ouvrage « extraction de la racine » dont MENNHER s'est spécialement occupé, avec la terminologie employée qui était celle des « Cossistes » et montre quelques problèmes, opérations, et dispositions de calcul relatifs à l'extraction des racines de nombres entiers, de fractions ou de « nombres irrationaux ». L. S.

Vetter, Quido. Sur l'équation du quarante-cinquième degré d'ADRIAAN VAN ROOMEN. *Bulletin des sciences mathématiques*, 54, 7 p., 1930. ISIS

B. — *Physical sciences and technology*

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C. — *Natural sciences*

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D. — *Medical sciences*

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L. G.

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Tamgrouti, Abou-l-Hasan Ali ben Mohammed. En-Nafhat el-Miskiya fi-s-sifarat et-Tourkiya. Relation d'une Ambassade marocaine en Turquie 1589-1591, trad. et annotée par H. DE CASTRIES. XVI+130 p. (Publications de la Section historique du Maroc. Documents d'Histoire et de Géographie marocaines). Paris, GEUTHNER, 1929. ISIS

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XVIIth Century (whole and first half)

A. — *Mathematics*

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our knowledge of the voyage of the Duifken is only secondhand, yet considering the sources from which it comes, the probability is high that it is trustworthy, and that consequently the York Peninsula was not only sighted, but touched at by the Dutch (1605) before TORRES passed through the strait. If in so doing any of the crew landed on the coast, the Dutch must have been the first to set foot on the Island Continent. On the other hand, if the neighbouring islands of Northern Australia are to be regarded as part of that continent, then the landing of de PRADO on the Isla de Perros in 10° S. lat. (1606) would give the discovery, so far as rests on direct evidence, to Spain."

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C. W. A.

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what is probably the best authenticated instance of longevity in a tortoise, it must be reckoned the last survivor of its race.

C. W. A.

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XIXth Century (whole and first half)

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1926, et K. ILLINGWORTH, 1927; nouveaux travaux de MICHELSON, 1926 et années suivantes; les expériences d'enregistrement photographique de A. PICCARD, 1926, 1927, de G. JOOS, 1930.

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D. — *Medical sciences*

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XXth Century

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C. — *Natural sciences*

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(Waterston James.) Obituary notice of JAMES WATERSTON. *Natural History Magazine*, 2, 247, London, 1930. ISIS

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C. W. A.

D. — *Medical sciences*

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Reviewed by FRANCIS R. PACKARD, *Annals of Medical History*, 3, 361, 1931.

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E. — *Alia*

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PART II

HISTORICAL CLASSIFICATION

Including only the items which could not be included in Part I—the fundamental (centurial) classification. Hence a student of Muslim science, for example, should not peruse simply the notes collected below under the heading "Islam," he should examine as well those included above under the headings VIIth century, VIIIth century, etc.

I. ANTIQUITY

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Étude approfondie, d'après les textes anciens, de la phtisie, de ses symptômes et de son traitement. On entendait par phtisie, non seulement l'affection pulmonaire, mais encore d'autres manifestations de la tuberculose.

L. S.

Bushnell, George Herbert. The world's earliest libraries. 58 p. London, GRAFTON, 1931. ISIS

Chapouthier, Fernand. Les écritures Minoennes au palais de Mallia, d'après le dépôt d'archives exhumé, sous la direction de CHARLES PICARD, par LOUIS RENAUDIN et JEAN CHARBONNEAUX. XII+99 p., 36 fig., 8 pl. Paris, GEUTHNER, 1930. ISIS

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Geffcken, Johannes. Der Ausgang des griechisch-römischen Heidentums. 2. Tausend, mit Nachträgen. 365 p. (*Religionswissenschaftliche Bibliothek*, hrsg. von W. STREITBERG, 6). Heidelberg, WINTER, 1929. ISIS

Reviewed by HENRI GRÉGOIRE, *Byzantion*, 5, 745-47, 1930.

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Hempl, George. Mediterranean studies. I., The genesis of European alphabetic writing. II., Minoan seals. Edited by FREDERICK ANDERSON. 95 p. Stanford, California, University Press, 1931. ISIS

Petrie, Sir Flinders. Decorative patterns of the ancient world. 17 p., 88 pl. London, British School of Archaeology in Egypt, 1930. ISIS

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Reviewed by CURT SACHS, *OLZ*, 34, 619, 1931.

Robinson, George Livingston. The sarcophagus of an ancient civilization : Petra, Edom and the Edomites. XXIII+495 p. New York, MACMILLAN, 1930. ISIS

2. — EGYPT

Bénédite, Georges. Terre d'Egypte. Ouvrage posthume publié par les soins de CHARLES BOREUX. 300 p., 40 pl., 50 figs. Paris, GEUTHNER 1931. ISIS

Boreux, Charles. L'art de la navigation en Egypte jusqu'à la fin de l'ancien empire. 328 p., 2 pl. Cairo, Institut français d'archéologie orientale, 1925. ISIS

Reviewed in *Ancient Egypt*, 90-91, 1926.

Bossert, Helmuth Th. Die Beschwörung einer Krankheit in der Sprache von Kreta. *OLZ*, 34, 303-29, 13 fig., 1931. ISIS

Breasted, James Henry. The Edwin Smith surgical papyrus. Published in facsimile and hieroglyphic transliteration with translation and commentary. Volume 1, Hieroglyphic transliteration, translation and commentary. XXIV+596 p., 8 pl. Volume 2. Facsimile plates and line for line hieroglyphic transliteration. 16 p., 46 pl. (*Oriental Institute publications*, vols. 3 and 4). Chicago, University Press, 1930. ISIS

Reviewed by GEORGE SARTON, *Isis*, 15, 355-67, 1931.

Capart, Jean. Note sur les bateaux préhistoriques. *Ancient Egypt*, 83, 1924. ISIS

Clarke, Somers. Nile boats and other matters. *Ancient Egypt*, 2-9, 40-51, 2 fig., 1920. ISIS

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Ghallab, Mohammed. Les survivances de l'Egypte antique dans le folklore égyptien moderne. 290 p. Paris, GEUTHNER, 1929. ISIS

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Grapow, Hermann. Die bildlichen Ausdrücke des Ägyptischen. Vom Denken und Dichten einer altorientalischen Sprache. 219 p. Leipzig, HINRICHS, 1924. ISIS

Reviewed by L. B. E., *Ancient Egypt*, 62, 1927.

Jarrett-Bell, C. D. Rowing in the XVIIIth dynasty. *Ancient Egypt*, 11-19, 4 fig., 1930. ISIS

Kleppisch, K. Die Cheopspyramide. 74 p. München, OLDENBOURG, 1921. ISIS

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Lint, J. G. de. Chirurgische tekst van den papyrus Edwin Smith. *Bijdragen tot de geschiedenis der geneeskunde*, 211-32, 1931. ISIS

Lint, J. G. de. De papyrus Edwin Smith. *Bijdragen tot de geschiedenis der geneeskunde*, 11, 193-211, 1931. ISIS

Lucas, A. Egyptian use of beer and wines. *Ancient Egypt*, 1-5, 1928. ISIS

Mace, Arthur C. Loom weights in Egypt. *Ancient Egypt*, 75-76, 1 fig., 1922. ISIS

Miller, G. A. A few theorems relating to the Rhind mathematical papyrus. *American Mathematical Monthly*, 38, 194-97, 1931. ISIS

Mitchell, C. Ainsworth. Marking-ink in Ancient Egypt. *Ancient Egypt*, 18, 1927. ISIS

Murray, M. A. The ceremony of Anba Tarabo. *Ancient Egypt*, 110-14, 1921. ISIS

"The ceremony is performed over a person bitten by a dog, in order that there may be no ill effects from the bite. As the proportion of fatal cases of dog-bite is only 15 per cent, even when the dog is mad, and as the greater number of bites are received from dogs which are not mad, the ceremony is naturally considered highly efficacious among a people who know nothing of percentages." And as in the Egyptian words "there are all the elements of the name of that otherwise unexplained saint Tarabo, I would suggest that we have, in this service for the cure of dog-bite, the survival of an ancient liturgy which reaches back perhaps to the XVIIIth dynasty, or perhaps even to a still earlier period, and that the name of the saint carries on the cult of an ancient Egyptian divinity."

Murray, M. A. Knots. *Ancient Egypt*, 14-19, 45 fig., 1922. ISIS

"From the evidence before us, it seems, therefore, that in the early dynasties knots were never represented. In the Middle Kingdom, though the same prejudice still existed, there was a movement towards an accurate presentation of the knot, showing that there was a change and that the old ideas were beginning to pass away."

Petrie, Flinders. The age of Egypt. *Ancient Egypt*, 33-42, 1929. ISIS

"Future discoveries will doubtless give further precision. Yet it may

be convenient to review the present position of the dynasties, according to the Egyptian reckoning, in the light of the present resettlement.

Dynasty I	begins	4530 B.C.	Dynasty X	begins	2814 B.C.
II		4300	XI		2629
III		3998	XII		2586
IV		3784	XIII		2375
V		3500	XIV		1922
VI		3282	XV		2375
VII		3084	XVI		2115
VIII		3014	XVII		1738
IX		2914	XVIII		1587."

Petrie, W. M. Flinders. The alphabet in the XIIth dynasty. *Ancient Egypt*, 1-3, fig., 1921. ISIS

Petrie, Flinders. The building of a pyramid. *Ancient Egypt*, 33-39, 2 fig., 1930. ISIS

Petrie, Flinders. The Caucasian Atlantis and Egypt. *Ancient Egypt*, 123-24, 1924. ISIS

Petrie, Flinders. The Egyptian lily. *Ancient Egypt*, 65-73, 72 figs., 1929. ISIS

Petrie, Flinders. Egyptian working drawings. *Ancient Egypt*, 24-27, 2 illus., 1926. ISIS

Petrie, W. M. Flinders. The metals in Egypt. *Ancient Egypt*, 12-23, 5 fig., 1915. ISIS

Petrie, Flinders. The origins of the book of the dead. *Ancient Egypt*, 41-45, 1926. ISIS

"It appears, then, that the cultural connections of the earliest Egyptians, as well as the physical descriptions in their mythology, point to the Caucasus region. When, further, we find there the names of the principal places of the mythology in their relative positions, it gives strong grounds for regarding that region as the homeland of the earliest civilisation of the Egyptians."

Quibell, J. E. The tomb of Hesy. 40 p., 32 pl. Cairo Museum, 1913. ISIS

Reviewed in *Ancient Egypt*, 37-41, 3 fig., 1915. Important for the study of Egyptian weights and measures. Beginning of IIIrd dynasty.

G. S.

Ross, Sir E. Denison. The art of Egypt through the ages. 354 p. London, The Studio, 1931. ISIS

Sethe, Kurt. Urgeschichte und älteste Religion der Ägypter. XI+196 p., 3 maps. (*Abhandl. f. d. Kunde des Morgenlandes*, XVIII. Bd., Nr. 4). Leipzig, BROCKHAUS, 1930. ISIS

Reviewed by T. ERIC PEET, *OLZ*, 34, 625-27, 1931.

Sloley, R. W. Ancient Clepsydrae. *Ancient Egypt*, 43-50, 6 fig., 1924. ISIS

"The Ancients made use of two kinds of Clepsydrae or Water Clocks, which may be distinguished conveniently as 'Outflow Clocks' and 'Inflow Clocks.' The former type appears to have originated in Egypt and consisted of a vessel shaped like a flower pot provided with one small aperture at the side near the bottom. The pot was filled with water, which flowed out gradually through the opening, and by noting the water level against a scale of markings on the inner surface, an estimate of the intervals of time was obtained. The other type came into use in later times and consisted of a pot of cylindrical shape, into which water was allowed to drip or which was placed in a larger vessel maintained full of water, which gradually flowed into the pot. The level of the water as it rose was indicated by the position of a float against a scale. The oldest specimen of water clock in existence is of the Outflow type and dates from the time of the Pharao AMENHOTEP III (c. 1400 B.C.)."

Sloley, R. W. Ancient Egyptian mathematics. *Ancient Egypt*, 111-17, 1922. ISIS

Sloley, R. W. Note on parabolic cones. *Ancient Egypt*, 16-17, 1927. ISIS

"Professor PETRIE recently called attention to the possible use of parabolic cones in the cylindrical clepsydra. Such a cone would enable an equally divided scale to be used in an 'outflow' clock in the form of a right cylinder of uniform diameter. In the Egyptological Museum at University College are two portions of cones which Professor PETRIE thought might have been used for the purpose, and he very kindly lent me the larger specimen in order that the necessary measurements might be made, to determine whether the section was or was not parabolic." "It may be stated that, allowing for the inequalities of the surface of the fragment which might affect diametral measurements and slight errors in the cutting of the templates, the surface does approximate so very closely to the parabolic form as to lead to the conclusion that it is possibly intentional. Unfortunately it is not possible to date the specimen."

Sobhy, Geo. P. G. Customs and superstitions of the Egyptians connected with pregnancy and child-birth. *Ancient Egypt*, 9-16, 1923. ISIS

Spanton, W. D. The water lilies of Ancient Egypt. *Ancient Egypt*, 1-20, 51 fig., 1917. ISIS

Tarrell, J.; Petrie, F. The great pyramid courses. *Ancient Egypt*, 36-39, 2 diagrams, 1925. ISIS

"It had not previously been noted how the variations of the thickness of different courses of the Great Pyramid tended to group around certain lengths, and the enquiry hence arose, was this grouping due to different standards of measure used by the masons? or was it due to multiples of the usual Egyptian digit which were chosen so as to unify the thickness of each course?"

Touraeff, B. The volume of the truncated pyramid in Egyptian mathematics. *Ancient Egypt*, 100-02, fig., 1917. ISIS

Apropos of the Moscow papyrus (*Isis*, 16, 148-55).

Vogel, Kurt. Zur Frage der Scheffelteile. *Zeitschrift für ägyptische Sprache und Altertumskunde*, 66, 33-35, 1930. ISIS

"In seinem Aufsatze ' Über den Scheffel und seine Teile ' (*Ä. Z.* 65, 1930, S. 42-48) stellt NEUGEBAUER die These auf, dass das System der ägyptischen Getreidemasse nicht homogen sei, sondern aus 2 ' Kernen ' bestehe. Neben dem auf dem *Hekat* (Scheffel) selbst aufgebauten System mit dezimalem Grundcharakter (100 H., 10 H., 1/10 H., 1/2 H. und andere ' natürliche ' Bruchteile) habe ein zweites bestanden, das sich um den Kern *Ro* gebildet habe mit den hauptsächlichen Vielfachen 10 und 20 *Ro*. Erst später seien die beiden Systeme, ' so gut es eben noch gehen wollte,' aneinandergeschlossen worden unter Fixierung des Verhältnisses *Hekat: Ro* = 320 : 1." „Ich komme auf Grund der gemachten Ausführungen zu dem Schluss, dass man recht gut an der bisherigen Auffassung der Scheffeleinteilung und der Scheffelrechnung sowie daran festhalten kann, dass diese sich nicht ' ausserhalb des Gebietes der Bruchrechnung vollzieht.' M.E. zeigt der Ägypter, dass er sich der Relativität zwischen Einheit und Vielheit wohl bewusst ist. Er kann jederzeit aus einer Einheit 320 Untereinheiten *(Ro)* machen und diese umgekehrt wieder zu einer grösseren ' 1 ' zusammenfassen. Dies alles ist um so selbstverständlicher, als es ja genau derselbe Gedanke ist, der ihn befähigt 10 und 100 *Hekat* wieder zu einer Übereinheit, zu einer neuen, grösseren ' 1 ' zu vereinigen. Dass er hierbei auf dem besten Wege zu einem ' Stellenwertsystem ' war, hat NEUGEBAUER auf S. 45 seines interessanten Aufsatzes überzeugend zum Ausdruck gebracht."

Wainwright, G. A. Obsidian. *Ancient Egypt*, 77-93, map, 1927. ISIS

Weill, Raymond. Bases, méthodes et résultats de la chronologie égyptienne. 63 p. Paris, GEUTHNER, 1928. ISIS

Reviewed in *Ancient Egypt*, 82, 1930; by E. PRZYBYLLOK, *OLZ*, 34, 439, 1931.

Whymper, Charles. Birds in ancient Egyptian art. *Ancient Egypt*, 1-5, 8 fig., 1915. ISIS

Winlock, H. E. Heddle-jacks of middle kingdom looms. *Ancient Egypt*, 71-74, 2 fig., 1922. ISIS

Wolf, Walther. Die Bewaffnung des altägyptischen Heeres. 108 p., 22 pl. Leipzig, HINRICHS, 1926. ISIS

Reviewed in *Ancient Egypt*, 62, 1926.

3. — BABYLONIA AND ASSYRIA

Dombart, Theodor. Der babylonische Turm. 36 p., 4 pl., 15 fig. (*Der Alte Orient*, Bd. 29, H. 2.) Leipzig, HINRICHS, 1930. ISIS

Reviewed by F. H. WEISSBACH, *OLZ*, 34, 533, 1931.

Ebeling, Erich. Tod und Leben nach den Vorstellungen der Babylonier. IX+177 p. Berlin, DE GRUYTER, 1931. ISIS

Furlani, Giuseppe. La civiltà babilonese e assira. VIII+520 p. Rome, Istituto per l'Oriente, 1929. ISIS

Reviewed by JULIUS LEWY, *OLZ*, 34, 346-48, 1931.

Peake, H. The flood : new light on an old story. X+124 p. London, KEGAN PAUL, 1930. ISIS

Reviewed in *Geography*, 15, 699, 1930. "The author was, perhaps, the first writer to interpret some discoveries made by M. DE MORGAN, at Susa, as evidence of a flood period, and in 1929 Mr. LEONARD WOOLLEY gave details of excavations revealing a layer composed of clean water-laid clay overlying the debris of an early settlement at Ur. Almost at the same time there came corroborative evidence from LANDGON and WATERLIN at Kish. The author describes and compares these deposits and now thinks that they relate probably to a single Great Flood rather than to a long period of floods."

C. W. A.

Speiser, Ephraim A. Mesopotamian origins. The basic population of the Near East. XIII+198 p. Philadelphia, University of Pennsylvania Press, 1931. ISIS

Unger, Eckhard. Die astronomische Uhr von Babylon. *Forsch. u. Fortschr.*, 7, 82, 1931. ISIS

Wetzel, Friedrich. Die Stadtmauern von Babylon. Mit einem Beitrag von ECKHARD UNGER. VIII+111 p., 83 pl., 2 fig. (*Ausgrabungen der Deutschen Orient-Gesellschaft in Babylon*, IV ; 48. Wiss. Veröffentl. der Deutschen Orient-Gesellschaft). Leipzig, HINRICHS, 1930. ISIS

Reviewed by U. HÖLSCHER, *OLZ*, 34, 439-41, 1931.

Woolley, C. Leonard. Ur und die Sintflut : 7 Jahre Ausgrabungen in Chaldäa, der Heimat ABRAHAMS. 137 p., 46 pl. Leipzig, BROCKHAUS, 1930. ISIS

4. — GREECE

Clerc, Michel. Massalia, histoire de Marseille dans l'antiquité, des origines à la fin de l'empire romain d'Occident. 2 vols., 480 p. ; 489 p. Marseille, TACUSSEL, 1927-1929. ISIS

Reviewed by L.A. CONSTANS, *Journal des Savants*, 460-67, 1930; 31-39, 1931.

Deichgräber, Karl. Die griechische Empirikerschule. Sammlung der Fragmente und Darstellung der Lehre. VIII+398 p. Berlin, WEIDMANNsche Buchh., 1930. ISIS

Reviewed by LUDWIG EDELSTEIN, *DLZ*, 2, 1113-20, 1931.

Dörpfeld, Wilhelm. Alt-Ithaka. Ein Beitrag zur HOMER-Frage. Studien und Ausgrabungen auf der Insel Leukas-Ithaka. Unter Mitarbeit von PETER GOESSLER, ERNST VAN HILLE, WILFRIED VON SEIDLITZ, RICHARD UHDE. 2 vols. XV+442 p., 89 pl., 20 maps. München, UHDE, 1927. ISIS

Reviewed by GEORG LIPPOLD, *DLZ*, 2, 781-84, 1931.

Eecke, Paul ver. Note sur un théorème de statique démontré dans l'antiquité grecque. *Mathésis*, 45, 84-86, 1931. ISIS

Enriques, F. Il principio de ragion sufficiente nel pensiero greco. *Scientia*, 48, 285-90, 1930 ; traduction française, *ibid.*, suppl., 99-103. ISIS

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II. MIDDLE AGES

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Ce rapport étayé d'une documentation fort riche dont les sources sont indiquées, est divisé comme suit : 1. Quel pouvait être le nombre des léproseries et des lépreux en Europe au moyen âge ?; 2. La croyance populaire à la contagion et à l'hérédité de la lèpre est générale au moyen âge; 3. La lèpre frappe toutes les conditions sociales; 4. L'esprit de charité qui anime les populations à l'égard des ladres peut faire place aux persécutions; 5. Les dispositions qui régissent la lèpre dans les coutumes germaniques, anglo-saxonnes et scandinaves; 6. Des mesures légales prises en Occident par l'Église et la Royauté à l'égard des lépreux aux périodes mérovingienne et carolingienne; 7. De la législation relative à la lèpre en France sous les rois de la troisième race; 8. État de la législation appliquée aux lépreux dans les diverses nations de l'Europe; 9. De la recherche des lépreux; 10. De la constitution du jury d'examen; 11. De l'épreuve des ladres; 12. Les experts doivent répondre aux deux questions suivantes : le suspect est-il lépreux et, dans l'affirmative, est-il parvenu au stade où l'isolement est obligatoire ?; 13. De la rédaction du certificat; 14. Des difficultés du diagnotic et du droit d'appel contre la sentence; 15. La « mise hors le siècle » et les « défenses »; 16. De l'isolement à domicile; 17. Site des léproseries; 18. Des divers types

de léproseries; 19. Des différentes catégories de personnes vivant dans une maladrerie; 20. La léproserie est un lazaret et non un lieu de cure; 21. Règles prophylactiques contenues dans les statuts des léproseries; 22. Statuts d'ordre moral ou disciplinaire contribuant indirectement à la prophylaxie; 23. Annexes des léproseries destinées aux ladres passants; 24. Statuts des léproseries autorisant les ladres à se rendre en ville sous certaines conditions. Leur concordance avec les réglements municipaux; 25. Des règles imposées aux ladres qui demandent l'aumône, vont chercher leur nourriture ou pénètrent dans les églises; 26. Défense faite aux ladres d'entrer dans les hôpitaux soit comme malades, soit comme serviteurs; 27. En principe le ladre, interné ou non, ne doit exercer aucun métier ou profession, et ne doit remplir aucune fonction sociale; 28. Infractions nombreuses aux règles prophylactiques; 29. Du déclin de la lèpre en Europe; 30. Le système défensif institué au moyen âge a-t-il été la cause principale du retrait de la lèpre?; 31. Comment la race juive s'est-elle comportée au moyen âge vis-à-vis de la lépre?; 32. Les progrès de l'hygiène domestique ont-ils coopéré à l'extinction de la lèpre?; 33. Effet des persécutions, des famines, des guerres et des épidémies, sur l'endémie lépreuse; 34. Conclusion. Pièces justificatives (p. 138-155), 33 documents cités. L'auteur conclut : « Des faits exposés dans ce rapport, il résulte que plusieurs causes ont coopéré à l'extinction de la lèpre en Occident. Si j'assigne le premier rang au système de défense et d'isolement pratiqué au moyen âge, je suis loin de méconnaître l'action d'autres causes auxiliaires, et en particulier des progrès de l'hygiène publique et privée, pendant la période qui s'étend du XIII^e^ au XVI^e^ siècle. »

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This Ph. D. thesis prepared under SINGER's direction reached me unfortunately just as I was preparing to sail for Europe. A rapid examination gave me a good opinion of it, and caused me to regret that it had not been available to me during the preparation of Vol. 2 of my *Introduction*. WINGATE's

survey was restricted to the biological works of ARISTOTLE, and to the *Physiognomia* and the *De plantis*. Special attention was paid to the last named work, since the alleged existence of a second Latin version of it formed the starting point of the author's researches. The book is divided as follows : I. Preliminary considerations. (1) Introduction; (2) Works in possession of the Latins before the new translations. The Boethian problem; (3) The Arabic ARISTOTLE; (4) The Byzantine ARISTOTLE. II. ARISTOTLE in the West. (1) The historical setting of the translations; (2) Some notes on the manuscripts of the scientific corpus; (3) Early evidences of diffusion of natural works; (4) Some Aristotelian florilegia and concordances; (5) The beginnings of the mediaeval translating movement. III. Twelfth-century versions of ARISTOTLE. (1) The physical and certain other works; (2) Biological works : from the Arabic; (3) Biological works : from the Greek. IV. Thirteenth-century versions of ARISTOTLE. (1) Biological works : from the Arabic; (2) Biological works : from the Greek; (3) Physical and certain other works. V. The thirteenth-century translators; Evidence of ROGER BACON. VI. Versions of commentaries. (1) Arabian commentators; (2) Greek commentators. VII. Some later Latin versions of the Aristotelian works. Sincere congratulations to the author for a most useful contribution.

G. S.

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III. ORIENTAL SCIENCE AND CIVILIZATION

8. — ASIA

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"In der Berliner Sammlung der Turfanfunde befinden sich einige uigurische Bruchstücke medizinischen Inhalts. Zu dieser kleinen Anzahl von Texten gehört auch dies vorliegende Buch das, weil es ein grösseres zusammenhängendes Stück darstellt, als Versuch in Angriff genommen werden konnte. Es besteht aus zehn nach chinesischer Sitte gefalteten, gelben und auf beiden Seiten beschriebenen, dünnen Doppelblättern und ist oben am offenen Rande mit einer gelblich-rosa Seidenschnur geheftet. Von der elften Doppelseite ist nur ein Teil erhalten. Wie man es an den mit der Schnur gehefteten Stellen ersehen kann, fehlen am Schluss des Buches noch mindestens vier Blätter. Die Seitengrösse beträgt 14 × 18 cm. Die erste und letzte Seite sind stark beschädigt." "Über das Alter der Handschrift lässt sich heute noch nicht viel sagen. Nach der Schreibweise und Ausführung gehört sie sicher nicht zu den frühen Handschriften. Bei einem flüchtigen Vergleich des Inhalts unserer Handschrift mit dem von solchen aus neuerer Zeit, treten unverkennbar deutlich drei Punkte hervor, die man wie folgt zusammenfassen könnte : 1. eigentliche türkische Volksmedizin, 2. Einfluss vom Osten, 3. Einfluss von Westen." Translation of the text with notes and medical index.

G. S.

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" When sickness comes in a Malay village the advice of a bomor, or physician of the native school, is sought : when childbirth occurs, a bidan or midwife is called in. From competent persons of those two classes we obtained information in the following way. We toured through the Peninsula, and by the kind help of administrative officers, to whom we return our sincere thanks, were put into touch with those whom we wished to meet. They were asked to give us as much information as they could and to bring specimens in illustration of their simples. At a second meeting the information was taken down, and the specimens ticketed. Subsequently the specimens, which are preserved in the herbarium of the Botanic Gardens, Singapore, were determined and the information worked up."

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"Some of the solutions of ĀRYABHAṬA are imperfect, of BRAHMAGUPTA the solutions are more accurate, while those of BHĀSKARA are generally mathematically correct. The date of the Scientific Hindu Astronomy is indeed 499 A.D., while that of the *Syntaxis* is about 150 A.D. It is by these shortcomings and differences in the methods, new ideas (e.g., the idea of the differential calculus) and the like that we can safely say that Hindu Astronomy in its scientific form, although of a later date than the *Syntaxis* of PTOLEMY, is original and not borrowed from a foreign source. There is evidence that some crude form of Greek astronomy was transmitted to India and went by the name of the "Romaka" or the "Paulisha" Siddhānta, prior to the time of ĀRYABHAṬA but our great Indian astronomers ĀRYABHAṬA with his pupils, VARĀHA-MIHIRA and BRAHMAGUPTA had to construct a new science altogether."

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Western science appeared in China with the translation of EUCLID (1607); pre-Newtonian astronomy was introduced by VERBIEST, a Jesuit priest in the 17th century. The real awakening came with the opening of the Naval Academy (1879), the Telegraphy School (1879), the Pei Yang University (1889), the University of Communications (1897), and the National University at Peking (1898), and with this early movement the translations of the works of LYELL, HERSCHEL, and TYNDALL.

With organization of education came the introduction of teaching the sciences of the Occident, and following upon this the organization of research. The Geological Survey of China was established in 1916, the Biological Laboratory of the Science Society of China in 1919, the Academia Sinica in 1927, the Fan Memorial Biological Survey in 1928, and the Peiping Research Institute in 1929.

C. A. K.

11. — JAPAN

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Goddard, Dwight. The BUDDHA's golden path. A manual of practical Buddhism, based on the teachings and practises of the Zen sect, but interpreted and adapted to meet modern conditions. XII+210 p. London, LUZAC, 1930. ISIS

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Takekoshi, Yosaburo. The economic aspects of the history of the civilization of Japan. In three volumes. Vol. 1, XXIX+555 p. Vol. 2, XVI+566 p. Vol. 3, XV+436 p. London, ALLEN and UNWIN, 1930. ISIS

12. — ISRAEL

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IX+464 p. (The Century Historical Series.) New York, Century, 1930. ISIS

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PART III

SYSTEMATIC CLASSIFICATION

Including only the material which could not be included in Parts I and II. Hence studies on Japanese astronomy or on XIIIth century astronomy are not classified below under astronomy, but above, respectively under Japan (in Part II) and S. XIII (in Part I).

The sections forming Part III are classified as follows :

I. *Science in general :* 15. Bibliography; 16. History; 17. Organization; 18. Philosophy.

II. *Formal sciences* (Knowledge of forms) : 19. Logic and Theory of Knowledge; 20. Mathematics; 21. Statistical methods.

III. *Physical sciences* (Knowledge of inorganic nature) : 22. Mechanics; 23. Astronomy; 24. Physics; 25. Chemistry (Physico-chemistry, Industrial chemistry); 26. Technology.

IV. *Biological sciences* (Knowledge of organic nature) : 27. Biology (Generalities, " Natural history "); 28. Botany (Agronomy, Phytopathology, Palaeobotany); 29. Zoology.

V. *Sciences of the earth* (Implying knowledge of both organic and inorganic nature) : 30. Geodesy; 31. Geography and Oceanography; 32. Geology, Mineralogy, Palaeontology, Mining; 33. Meteorology, Climatology and Terrestrial Physics.

VI. *Anthropological and historical sciences* (Knowledge of man, past and present) : 34. Anatomy; 35. Physical anthropology (anthropometry and races of man); 36. Physiology (human and comparative); 37. Psychology (human and comparative); 38. Archaeology (generalities, methods); 39. Prehistory; 40. Ethnology (primitive and popular science); 41. Superstition and Occultism.

42. Economics (economic doctrines and history ; commerce ; transportation and communications); 43. Sociology, Jurisprudence and Positive polity; 44. History of Civilization (general history, historical methods, biography and chronology); 45. History of Art (art and science; iconography; arts and crafts); 46. History of Language, Writing and Literature; 47. History of Morals (moral organization of society); 48. History of Philosophy; 49. History of Religion (science and religion).

VII. *Medicine :* 50. History, organization and philosophy of medicine; 51. Epidemiology, History of special diseases. Public health and Social medicine; 52. History of hospitals and of medical teaching; 53. Pharmacy; Pharmacology; Toxicology.

VIII. *Education* (The methods of accumulating, imparting and diffusing knowledge); 54. Education (generalities, methods, colleges, universities); 55. Academies, Societies, Congresses. National and international organization of science; 56. Bibliography (methods, libraries); 57. Museology (museums and collections).

IX. 58. Alia; 59. Errata.

The applied sciences are not disconnected from the pure sciences, but, as far as possible, the principles and applications of science are considered in the same section. However, applications based upon the principles of many sciences are dealt with separately (e.g. technology; medicine; education).

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18. — PHILOSOPHY OF SCIENCE

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II. FORMAL SCIENCES

(Knowledge of forms)

19. — LOGIC AND THEORY OF KNOWLEDGE

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Klether, Bruno. Magische Zahlenquadrate : Mechanische gemeinverständliche Lösungen für alle Arten von Quadraten. VII+55 p. Wien, BRAUMÜLLER, 1930. ISIS

Kraitchik, Maurice. La mathématique des jeux ou récréations mathématiques. VII+566 p., 965 fig., Bruxelles, STEVENS, 1930. ISIS

M. KRAITCHIK, à qui l'on doit entre autres une *Théorie des nombres* (2 vol. 1922-26), des *Recherches sur la théorie des nombres* (2 vol. 1924-29) et une *Théorie mathématique des opérations financières*, qui vient de fonder (février 1931) une revue de récréations mathématiques (*Sphinx*, Bruxelles) reprend dans ce volume consacré à la Mathématique des jeux, d'anciens problèmes tirés de l'Anthologie grecque, des problèmes arabes, des problèmes hindous, quelques problèmes donnés par N. CHUQUET, C. CLAVIUS, C. G. BACHET, I. OZANAM, et des problèmes plus récents tirés d'autres auteurs qu'il a le tort de négliger de nous faire connaître. Il y ajoute naturellement des problèmes de son invention, mais on ne sait jamais ce qui lui est propre, et ce qui est emprunté. Son ouvrage se compose de deux parties d'une importance à peu près égale : la première est consacrée aux jeux de calcul, et la place la plus considérable est prise par les carrés magiques; la seconde a trait aux jeux de situation, où le calcul ne constitue pas la partie essentielle : bon nombre de problèmes indiqués sont des problèmes d'échecs; mais l'auteur décrit aussi un nouveau jeu de combinaison auquel il donne le nom de tricolor, et qui semble se prêter à de curieux problèmes.

L. G.

Kraitchik, M. Traité des carrés magiques. 108 p., Paris, GAUTHIER-VILLARS, 1930. ISIS

Reviewed by P. J. RICHARD, *Revue générale des sciences*, 42, 121, 1931.

Lietzmann, Walther. Lustiges und Merkwürdiges von Zahlen und Formen. 4te Aufl. VI+307 p. Breslau, HIRT, 1930. ISIS

Reviewed by DAVID EUGENE SMITH, *American Mathematical Monthly*, 38, 224-25, 1931.

Lietzmann, Walther. Mathematik und bildende Kunst. 150 p. Breslau, HIRT, 1931. ISIS

Reviewed by DAVID EUGENE SMITH, *American Mathematical Monthly*, 38, 224-25, 1931.

Lietzmann, W. Der Pythagoreische Lehrsatz : mit einem Ausblick auf das Fermatsche Problem. IV+71 p. Vierte durchgesehene Auflage. (*Mathematisch-physikalische Bibliothek*, Bd. 3). Leipzig, TEUBNER, 1930. ISIS

Loria, Gino. Il passato e il presente delle principali teorie geometriche : storia e bibliografia. Quarta edizione totalmente rifatta. XXIII+467 p. Padova, MILANI, 1931. ISIS

Macaulay, I. F. S. Obituary notices of WILLIAM JOHN GREENSTREET (1861.8.18-1930.6.28). *Mathematical Gazette*, 15, 181-86, 1930. ISIS

Editor of *Mathematical Gazette*, 1898-1930. "His knowledge of what had been written in the range of modern elementary mathematics was probably greater than that of any other living person." "He had an immense knowledge of the personalities of literary, scientific and social history."
C. W. A.

Rademacher, Hans ; Toeplitz, Otto. Von Zahlen und Figuren : Proben mathematischen Denkens für Liebhaber der Mathematik. VI+164 p. Berlin, SPRINGER, 1930. ISIS

Reviewed by T. G., *Nature*, 127, 480, 1931.

Tropfke, Johannes. Geschichte der Elementar-Mathematik in systematischer Darstellung mit besonderer Berücksichtigung der Fachwörter. Band 1 : Rechnen. Dritte, verbesserte und vermehrte Auflage. VII+222 p. Berlin, DE GRUYTER, 1930. ISIS

Reviewed by T. L. H., *Nature*, 127, 921-22; by DAVID EUGENE SMITH, *American Mathematical Monthly*, 42, 331-34, 1931.

Turnbull, H. W. The great mathematicians. VIII+128 p. London, METHUEN, 1929. ISIS

Reviewed in *Mathematical Gazette*, 15, 172-73, 1930.

Weyl, Hermann. Die Stufen des Unendlichen : Vortrag, gehalten am 27. Oktober 1930 bei der Eröffnung der Gästetagung der Mathematischen Gesellschaft an der Universität Jena im Abbeanum. Jena, FISCHER, 1931. ISIS

III. PHYSICAL SCIENCES
(Knowledge of inorganic nature)

22. — MECHANICS
(Including celestial and atomical mechanics)

Nubar, Zareh. Le premier principe rien n'est arbitraire : la mécanique fondée sur une théorie des chocs durs. IV+407 p. Paris, BLANCHARD, 1930. ISIS

23. — ASTRONOMY

Antoniadi, E. M. La planète Mars. Etude basée sur les résultats obtenus avec la grande lunette de l'Observatoire de Meudon et exposé analytique de l'ensemble des travaux exécutés sur cet astre depuis 1659. 240 p. gr. 4°, 150 fig., 10 pl., Paris, HERMAN et Cie. 1930 (80 fr.) ISIS

En dehors des nombreuses observations qu'il a faites lui-même de Mars depuis 1888 à Meudon, ANTONIADI s'est donné la peine d'analyser tous les travaux exécutés sur cette planète depuis les premiers croquis de HUYGENS, en 1659. Il présente aujourd'hui l'ensemble de ces recherches en un fort beau livre qui constitue l'historique complet de chaque point de la surface de l'astre. J'ouvre le livre au hasard, p. 165, par exemple : *Mare chronicum;* après avoir indiqué sa situation, sa forme, l'auteur ajoute : « Elle a été représentée d'abord par MARALDI en 1704, puis par HERSCHELL en 1783. BEER et MAEDLER la voyaient bien en 1830 dans leur 0m,109, moins nettement en 1832. Puis SCHMIDT, en 1845, SECCHI, KAISER, LOCKYER en 1862, KAISER et DAWES en 1864, FLAMMARION, TERBY, NIESTEN, HARKNESS, GREEN et SCHIAPARELLI en 1877 la dessinaient d'une manière satisfaisante. KEELER la voyait plus étroite en 1892, et le 0m,83 me révéla ici des côtes irrégulières ». Suit l'historique des notations de couleur du même accident de la planète.

Cet historique ainsi compris, présenté sous le titre général : la topographie de Mars, occupe la plus grande partie du volume : 162 p.

La première partie (pp. 3-59) est réservée aux généralités : Mars dans l'Antiquité; instruments et stations; éléments astronomiques et physiques; les taches de la surface; l'illusion des canaux; les calottes neigeuses des pôles; l'atmosphère de Mars, ses nuées, ses vents; conditions physiques et habitabilité; les deux satellites de Mars.

Une table analytique et alphabétique complète heureusement ce travail très important.

L. G.

Eddington, Sir **A. S.** Sterne und Atome. Zweite Auflage. Ins Deutsche übertragen und mit der dritten englischen Auflage in Übereinstimmung gebracht v. O. F. BOLLNOW. V+125 p. Berlin, SPRINGER, 1931. ISIS

Hallo, Rudolf. Die Sternwarten Kassels in hessischer Zeit. 51 p., 12 fig. Kassel, 1929. ISIS

Reviewed by E. ZINNER in *Vierteljahrsschrift der Astronomischen Gesellschaft*, 66, 15-16, 1931.

Hirschberg, Walter. Die Plejaden in Afrika und ihre Beziehung zum Bodenbau. *Z. Ethnol.*, 61, 321-27, 1929. ISIS

Horsburgh, Ellice M. The cross-staff and its use in navigation. *The Scottish Geographical Magazine*, 46, 92-100, 7 ills., 1930. ISIS

Jeans, Sir James. L'univers. Traduit de l'anglais par GEORGES CROS. (Bibliothèque scientifique.) 288 p., 24 fig., 24 pl., Paris, PAYOT, 1930. ISIS

Jeans, Sir James. The stars in their courses. XI+188 p., 47 pl. Cambridge, University Press, 1931. ISIS

Jeans, Sir James. Sterne, Welten und Atome. Übersetzt v. R. NUTT. 384 p. Stuttgart, Deutsche Verlagsanstalt, 1931. ISIS

Shapley, Harlow. Flights from Chaos : a survey of material systems from atoms to galaxies. Adapted from lectures at the College of the City of New York, class of 1872 Foundation. VII+168 p. New York, MCGRAW-HILL, 1930. ISIS

Jerphanion, G. de. D'où vient l'écart entre la Pâque des Orientaux et celle des Latins ? Brève histoire du comput pascal. Etudes, 20 avril 1924. Réimprimé dans le livre du même auteur, La voix des monuments. Notes et études d'archéologie chrétienne (p. 296-321, Paris, VAN OEST, 1930.) ISIS

Contient une très belle photographie de la statue de saint Hippolyte au musée du Latran, montrant les tables gravées sur les côtés du siège, qui constituent le plus ancien essai de comput pascal (A.D. 222).

G. S.

Kilényi, B. Otto. Geschichte der ungarischen Astronomie. Astronomische Abhandlungen des Kön. Ung. Astrophysikalischen Observatoriums von Konkolys Stiftung in Budapest-Svábhegy. Bd. 1, Nr. 2, 106 p. Budapest, 1930. ISIS

Reviewed by E. ZINNER, *Vierteljahrsschrift der Astronomischen Gesellschaft*, 66, 17-18, 1931.

Lange, Ludwig. "Paradoxe" Osterdaten im Gregorianischen Kalender

und ihre Bedeutung für die moderne Kalenderreform. 85 p. (*Sitzungsber. d. Bayer. Akad. d. Wiss.*, philos.-philol. u. hist. Kl., Jg. 1928). München, OLDENBOURG, 1928. ISIS

Reviewed by **A. KOPFF**, *DLZ*, 1, 667, 1930.

Lehmann-Nitsche, Robert. Der Hochaltar des Sonnentempels in Cuzco. 3 figs. *Forschungen und Fortschritte*, 7, 195-97, 1931. ISIS

A study of an illustration from the " Relacion " by the Indian Pachacuti Salcamayahua. The identification of the constellation of the " Golden Jaguar " with Scorpio is especially remarkable.

A. P.

Ludendorff, H. Die astronomische Bedeutung der Seiten 51 und 52 des Dresdener Maya-Kodex. 14 p., pl. (*Unters. z. Astr. der Maya*, Nr. 3). *Stzgsber. Preuss. Ak. Wiss.*, phys.-math. Kl., 1931. ISIS

Ludendorff, H. Das Mondalter in den Inschriften der Maya. *Unters. z. Ast. der Maya*, Nr 4.) *Stzgsber. Preuss. Ak. Wiss.*, phys.-math. Kl., 40-62, 1931. ISIS

24. — PHYSICS

Cabannes, Jean. L'anisotropie optique des molécules. Nos connaissances actuelles sur l'effet RAMAN. 65 p. Paris, HERMANN, 1930. ISIS

Conférence faite au Conservatoire national des Arts et Métiers les 2 et 3 mai 1930.

Dorner, O.; Hamacher, J. Vom deutschen Anteil an der physikalischen Forschung. Heft 1. Begründer und Führer der klassischen Physik. VI+71 p. Leipzig, TEUBNER, 1930. ISIS

Reviewed by WIELEITNER, *Mitteilungen zur Geschichte der Medizin und der Naturwissenschaften*, 30, 94, 1931.

Glazebrook, Sir Richard. Standards of measurement : their history and development. *Nature*, 128, 17-28, 1931. ISIS

Gliozzi, Mario. Idea de temperatura et historia de thermometro. *Schola e vita*, 6, 21-24, 1931. ISIS

Gliozzi, Mario. Le origini della fisica sperimentale : la determinazione del peso specifico dell'aria. *Period. di mat.*, 11, 1-10, 1931. ISIS

Podolsky, Edward. Physician physicists. *Annals of Medical History*, 3, 300-07, 1913. ISIS

25. — CHEMISTRY, PHYSICO-CHEMISTRY, INDUSTRIAL CHEMISTRY

Brunold, Charles. Le problème de l'affinité chimique et l'atomistique : étude du rapprochement actuel de la physique et de la chimie. v+118 p. Paris, MASSON, 1930. ISIS

Reviewed in *Nature*, 127, 300-01, 1931.

Gregory, Joshua C. A short history of atomism : from DEMOCRITUS to BOHR. vi+258 p. London, BLACK, 1931. ISIS

Holmyard, Eric John. Makers of chemistry. xv+314 p., 98 illus. Oxford, Clarendon Press, 1931. ISIS

This attractive book on the history of chemistry reaches me just as I am preparing to sail for Europe. The first impression is excellent. I think it will be a very useful textbook for the teaching of the history of alchemy. The illustrations are abundant and well chosen. The whole field is covered from the days of early Egypt to our own; a fair amount of space is devoted to Arabic alchemy of which the author has first-hand knowledge (p. 41 to 84). Says the Preface : " In this book I have tried to tell the story of chemistry from its remote and obscure beginnings up to the establishment of the modern science by DALTON, LAVOISIER, AVOGADRO and their contemporaries. Brief sketches of subsequent developments have been appended in order that the reader may perceive something of the wonderful efflorescence of chemical progress in the nineteenth and twentieth centuries, though a full treatment of this progress lay outside the present limits. Like the other volumes in this series of *Makers of Science*, Makers of Chemistry is primarily intended for the general reader, to whom a detailed account of the chemistry of the last hundred years would necessarily prove unintelligible unless he were equipped with more than a little technical knowledge. If my narrative enables those with no special scientific training to understand how the great and fascinating science of chemistry slowly took shape, until at length it was set firmly upon its present fruitful course, I shall have achieved the object with which I set out." " Several of the illustrations are reproduced from originals in the Stone Memorial Science Library of Clifton College, which is fortunate in possessing a large and valuable collection of alchemical and early chemical books and manuscripts."

G. S.

Hurd, Charles B. The progress of chemistry. Faculty Papers of Union College, Albany, N. Y., 2, 103-13, 1931. ISIS

Kopp, H. Geschichte der Chemie. Neudruck der Original-Ausgabe

(1843-1847, 4 Teile). Teil 1, 455 p.; Teil 2, 426 p.; Teil 3, 372 p.; Teil 4, 448 p. In 2 Bänden. Leipzig, LORENTZ, 1931. ISIS

Miall, Stephen. A history of the British chemical industry. Written for the Society of Chemical Industry on the occasion of the fiftieth anniversary of its foundation. XVI+273 p. London, BENN, 1931. ISIS

Sebelien, John. Early copper and its alloys. *Ancient Egypt*, 6-15, 1924. ISIS

26. — TECHNOLOGY

(For Industrial chemistry, see 25. *Chemistry*; *for Mining,* 32. *Geology. See also Arts and crafts under* 45.*)*

Batten, M. I. English windmills. Volume 1. Containing a history of their origin and development, with records of mills in Kent, Surrey and Sussex. XVIII+128 p. London, Architectural Press, 1931. ISIS

Charbonnier, Prosper Elie. Essais sur l'histoire de la balistique. (Extrait du Mémorial de l'artillerie française). 334 p., ill., facs. Paris, Soc. d'édit. géographiques, maritimes et coloniales, 1928. ISIS

Reviewed by L. GUINET, *Isis*, 15, 376-80, 1931.

Clowes, G. S. Laird. Sailing ships, their history and development. As illustrated by the collection of ship models in the Science Museum. Part 1. Historical notes. 115 p. London, H. M. Stationery's Office, 1931. ISIS

Cutler, Carl. Greyhounds of the sea: the story of the American clipper ship, with a foreword by CHARLES FRANCIS ADAMS. XXVII+592 p., 118 ill. New York, PUTNAM, 1930. ISIS

Reviewed by LYNN THORNDIKE, *Isis*, 15, 381, 1931.

Ebermann, Oskar. Sagen der Technik. Von Fliegern und Schiffern, Brücken und Bauten, Uhren, Glocken und Zauberspiegeln und wunderbarem Hausgerät. Nach alten Quellen berichtet. 140 p., 20 ills. Leipzig, HEGEL u. SCHADE, 1930. ISIS

Hamilton, J. G. de Roulhac. The Ford Museum. *American Historical Review*, 36, 772-75, 1931. ISIS

Helmholtz, R. von ; Staby, W. Die Entwicklung der Lokomotive im Gebiete des Vereins deutscher Eisenbahnverwaltungen. Bd. 1. III+446 p., 39 pl. München, OLDENBOURG, 1930. ISIS

Jaffé, Albert. Zur Geschichte des Papieres und seiner Wasserzeichen. Eine kulturhistorische Skizze unter besonderer Berücksichtigung des Gebietes der Rheinpfalz. 29 p., 10 pl., 73 fig. Pfälz. Museum, 47, 1930. ISIS

Jervis, W. W. ; Jones, S. J. The paper-making industry in Somerset. *Geography*, 15, 625-29, 1930. ISIS

Historical notes covering the last two hundred years.

C. W. A.

Petersen, Kurt. Die geschichtliche Entwicklung der Glasindustrie im Rheinland. 104 p. Mülheim-Ruhr, RÜHL, 1930. ISIS

Pope, Saxton T. A study of bows and arrows. 102 p. Berkeley, University of California Press, 1931. ISIS

Schmitthenner, Paul. Krieg und Kriegführung im Wandel der Weltgeschichte. 452 p. (*Museum der Weltgeschichte*, hrsg. von PAUL HERRE.) Wildpark-Potsdam, Athenaion, 1930. ISIS

Reviewed by ROBERT G. ALBION, *American Historical Review*, 36, 787-88, 1931.

Straker, Ernest. Wealden iron. 492 p., 100 ills., 18 maps by BARTHOLOMEW. London, BELL and SONS, 1931. ISIS

A monograph on the former ironworks in the counties of Sussex, Surrey and Kent, comprising a history of the industry from the earliest times to its cessation; together with a topographical survey of the existing remains from personal observation.

IV. BIOLOGICAL SCIENCES

(Knowledge of organic nature)

27. — BIOLOGY

(Generalities, " Natural History ")

Almquist, Ernst. Grosse Biologen : eine Geschichte der Biologie und ihrer Erforscher. 143 p., 17 pl. München, LEHMANN, 1931. ISIS

Artschwager, Ernst Friedrich. Dictionary of biological equivalents :

German-English. 239 p., 6 pl. Baltimore, WILLIAMS and WILKINS, 1930. ISIS

Guyénot, E. La variation et l'évolution. II. L'évolution. 414 p. ill., Paris, GASTON DOIN, 1930. ISIS

Cet ouvrage complète l'étude consacrée par GUYÉNOT à la variation (*Isis*, 15, 471). Ni les théories qui se réclament de LAMARCK, ni celles qui se réclament de DARWIN ne nous apportent une représentation adéquate du mécanisme de la transformation des êtres organisés. Les mutations, au contraire, sont de véritables variations évolutives; c'est avec elles qu'il faut construire une théorie du transformisme, étant entendu que « le problème de l'évolution ne se pose pas à l'échelle de l'espèce linnéenne, mais à celle de l'espèce élémentaire » et que « les grandes étapes de l'évolution, celles qui ont engendré les embranchements ou les classes des êtres vivants, nous échappent presque entièrement ».

L. G.

Haldane, J. S. The philosophical basis of biology. Donnellan lectures, University of Dublin, 1930. X+169 p. London, HODDER and STOUGHTON, 1931. ISIS

Hogben, Lancelot. The nature of living matter. IX+316 p. London, KEGAN PAUL, 1930. ISIS

Reviewed by D. M. S. W., *Nature*, 127, 350-51, 1931.

Imms, A. D. Social behaviour in insects. X+117 p., 20 figs. (The Dial Press Monographs on Biological subjects). New York, MAC VEAGH, 1931. ($ 1.50). ISIS

This booklet is a brief résumé of current knowledge of the structural features of the nervous system and sense organs in wasps, social bees, ants, and termites, which afford a basis for the social organizations of these insects. The evolution of the social instincts is traced from their simpler forms in the subsocial cockroaches to their highest expressions in the ants and termites. Polymorphism, the origin of castes, and social parasitism are discussed. Organic memory, the homing instinct, control of reproduction, the relation of sterile castes to heredity and to specialized functions, the independent origins of comparable social units in different groups of non-social insects, the development and appropriation of unique sources of food, the methods of communication within the colony, the geological age of social insects, and the submergence of the individual in the life of the colony, all raise interesting biological, philosophical, and social questions.

C. A. K.

Jennings, H. S. The biological basis of human nature. XVIII+384 p. London, FABER and FABER, 1930. ISIS

Reviewed in *Nature*, 127, 263-64, 1931.

Needham, Joseph. The sceptical biologist. 270 p. New York, NORTON, 1930. ISIS

Reviewed by W. J. CROZIER, *Journal of General Psychology*, 5, 129-31, 1931.

Rádl, Emanuel. The history of biological theories. Translated and adapted from the German by E. J. HATFIELD. XII+408 p. Oxford, University Press, 1930.

Reviewed by G. SARTON, *Isis*, 15, 195-96, 1931.

Rose, Maurice. La question des tropismes. VII+469 p., 90 fig. (*Les problèmes biologiques*, XIII). Paris, Presses Universitaires de France. ISIS

Reviewed by W. J. CROZIER, *Journal of General Psychology*, 5, 131-34, 1931.

Russell, E. S. The interpretation of development and heredity : a study in biological method. VI+312 p. Oxford, Clarendon Press, 1930. ISIS

Reviewed J. GRAY, *Nature*, 127, 920-21, 1931.

Singer, Charles. A short history of biology. A general introduction to the study of living things. XXXV+572 p. Oxford, Clarendon Press, 1931. ISIS

Wells, H. G. ; Huxley, Julian ; Wells, G. P. The science of life. XVI+896 p. London, CASSELL, 1931. ISIS

Reviewed in *Nature*, 127, 477-79, 1931.

28. — BOTANY

(Agronomy, Phytopathology, Palaeobotany)

Alviella, Goblet d'. Histoire des bois et forêts de la Belgique. Tome IV. (Des origines à la fin du régime autrichien). 448 p., 22 pl. Paris, LECHEVALIER, 1930. ISIS

Reviewed by B. M. B., *Revue générale des sciences*, 42, 282, 1931.

Bruttini, Arturo. Dictionnaire de sylviculture. 384 p. Paris, LECHEVALIER, 1930. ISIS

Reviewed by G. D., *Revue générale des sciences*, 42, 91, 1931.

Cudell, Robert. Die Sammlung Neuerburg. Ein Büchlein vom Rauchen und Rauchgerät. 59 p., 70 pl. Köln, NEUERBURG, 1930. ISIS

Egli, Martha. Benennungsmotive bei Pflanzen an schweizerdeutschen

Pflanzennamen untersucht. IV+156 p. (Zürich, Philos. Diss.) Bülach, STEINEMANN-SCHEUCHZER, 1930. ISIS

Reviewed by MARZELL, *Mitteilungen zur Geschichte der Medizin und der Naturwissenschaften*, 30, 105, 1931.

Hurry, Jamieson B. The woad plant and its dye. XXVIII+328 p., 17 pl. Oxford, University Press, 1930. ISIS

Reviewed by E. F. ARMSTRONG, *Nature*, 127, 658-59, 1931.

Issa Bey, Ahmed. Dictionnaire des noms des plantes en latin, français, anglais et arabe. XIV+227+64 p. (Publication du Ministère de l'Instruction Publique d'Egypte). Cairo, 1930. ISIS

Jost, Ludwig. Die Entstehung der grossen Entdeckungen in der Botanik. Rede zur Reichsgründungsfeier am 18. Januar, 1930. 29 p. Heidelberg, WINTER, 1930. ISIS

Reviewed by ZAUNICK, *Mitteilungen zur Geschichte der Medizin und der Naturwissenschaften*, 30, 102, 1931.

Marzell, H. Pflanzengallen im Volksglauben. *Der Naturforscher*, 7, 430-36, 1930/31. ISIS

Ramsbottom, J. Exhibition of historical collections in the department of botany. *Natural History Magazine*, 2, 266-70, London, 1930. ISIS

Notes on the growth of the plant collections, from the purchase of the Sloane collections in 1753 until the formation of the botany branch of the natural history department in 1835.

C. W. A.

29. — ZOOLOGY

Essig, E. O. A history of entomology. VII+1029 p. New York, MACMILLAN, 1931. ISIS

Grégoire, Henri. Les sauterelles de SAINT JEAN-BAPTISTE. Texte épigraphique d'une épître de S. ISIDORE de Péluse. *Byzantion*, 5, 109-28, 1930. ISIS

Gudger, Eugène W. The candiru, the only vertebrate parasite of man. Foreword by A. C. WARTHIN. XVIII+120 p., 18 ill., New York, P. B. HOEBER, 1930. ISIS

« Candirú » est le nom donné à de petits poissons-chats de l'Amazone et de ses tributaires, qui ont la réputation de s'introduire dans l'urèthre des hommes ou la vulve des femmes, s'il leur arrive d'uriner dans l'eau.

GUDGER a réuni toute la littérature sur la question [la première mention du fait se trouve dans la préface écrite par MARTIUS pour « Selecta genera » de SPIX et AGASSIZ (1829)]; il a interrogé des médecins ayant séjourné dans le bassin de l'Amazone; et si incroyable que paraisse ce cas de parasitisme, GUDGER conclut à sa réalité. Les « candirú » appartiennent à la famille des *Pygidiidae*, dans lesquels C. H. EIGENMANN a ouvert en quelque sorte pour eux le genre *Urinophiles*. GUDGER ne croit cependant pas à l'urinophilie des candirú, mais à leur urinotropisme. Ce mémoire avait précédemment paru aux numéros de janvier et février 1930 de *The American Journal of surgery*.

L. G.

Innis, Harold A. The fur trade in Canada : an introduction to Canadian economic history. 444 p., map, illus. New Haven, Yale University Press, 1930. ISIS

Reviewed by CHARLES C. COLBY, *Geographical Review*, 336, 1931.

Oudemans, A. C. Kritisch-historisch overzicht der acarologie. Eerste gedeelte, 850 v. Chr. tot 1758. VIII+500 p., 70 fig. (*Tijdschrift voor entomologie*, 69, Supplement, October, 1926). The Hague, NIJHOFF, 1926. ISIS

Reviewed by GEORGE SARTON, *Isis*, 15, 381-86, 1931.

Pax, F.; Tischbierek, H. Schlesische Bibliographie. XII+520 p. (Hrsg. von der Historischen Kommission für Schlesien. Bd. V. *Bibliographie der Schlesischen Zoologie*.) Breslau, PRIEBATSCH, 1930. (RM. 18.-). ISIS

This is an exhaustive classified bibliography of 6852 titles, distributed under 211 rubrics, of the books and articles published in periodicals dealing with the fauna of Silesia. It includes not only those contributed to scientific journals, but also significant articles from the non-scientific press. It covers both the recent and the fossil fauna and includes the fields of apiculture, silkworm culture, fisheries, hunting, bird protection, animal farms and zoological parks, but not aviculture nor domestic animals. There are extensive author, place, and subject indexes. The highest bibliographic standards have been maintained throughout with meticulous care. It is the most extensive bibliography of its kind published on any territory. It is of interest to note that the previous volume in the series dealt with botany and contained only 167 pages, as compared with 520 devoted to zoology, an indication either of relative interests in the two fields, or of a differential productiveness of Silesian botanists and zoologists.

C. A. K.

Semple, Arthur T. The origin of domestic cattle. The progenitors of one of the most important of our domestic animals—their wild forebears and the steps by which these wild creatures have been domesticated and the influences that have changed them. *Natural History*, 31, 287-99, 1931. ISIS

Seyffert, Carl. Biene und Honig im Volksleben der Afrikaner mit besonderer Berücksichtigung der Bienenzucht, ihrer Entstehung und Verbreitung. Ein Beitrag zur Völkerkunde und Kulturgeschichte, besonders Afrikas. 209 p., 4 maps. (*Veröffent. d. Staatl.-Sächs. Forschungsinst. f. Völkerkd.* in Leipzig. 1. Reihe : Ethnographie u. Ethnologie. Bd. 3.) Leipzig, VOIGTLÄNDER, 1930. ISIS

Reviewed by HANS DAMM, *DLZ*, 2, 708-10, 1931.

Wheeler, William Morton. Demons of the dust, a study in insect behavior. XVIII+378 p. London, KEGAN PAUL, 1931. ISIS

Williams, C. B. The migration of butterflies. XI+473 p. (Biological monographs and manuals). Edinburgh, OLIVER and BOYD, 1930. ISIS

Reviewed by E. B. P., *Nature*, 127, 807-09, 1931.

V. SCIENCES OF THE EARTH

(Implying knowledge of both organic and inorganic nature)

30. — GEODESY

Dehalu, M. La figure de la terre déduite des mesures géodésiques. *Bulletin du Cercle des géographes liégeois*, 2, 14-27, 1930. ISIS

Helbronner, Paul. La genèse de l'opération de la jonction geodésique directe de la Corse à la chaîne méridienne des Alpes. *Revue générale des sciences*, 42, 359-66, 499-507, 676-81, 703-13, 1931. ISIS

Webb, R. Stretton. Notes on the history of geodesy. *South African Survey Journal*, 286-91, 1930. ISIS

31. — GEOGRAPHY AND OCEANOGRAPHY

Alfano, G. B. ; Friedlaender, I. Die Geschichte des Vesuv. Berlin, 1929. ISIS

Almagià, Roberto. Per una collezione sistematica di riproduzioni di carte antiche delle diverse regioni europee. (*International geographical congress*, Cambridge, 1928. *Report of the proceedings*). p. 406-08, 1930. ISIS

Almagià, Roberto. Presentazione dell'opera " Monumenta cartographica Italiae." (*International geographical congress*, Cambridge, 1928. *Report of the proceedings*). p. 396-400, 1930. ISIS

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Baschin, Otto. Royal geographical society, 1830-1930. *Die Naturwissenschaften*, 18, 659-62, 1930. ISIS

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Reviewed in *Geographical Journal*, 76, 559, 1930. "The travellers dealt with range from early chroniclers like STUMPF, TCHUDI, MÜNSTER, and MERIAN, and tourists in the more ordinary sense or mere birds of passage like CORYATT, BURNET, COXE, and WORDSWORTH, to scientists such as GESNER, SCHEUCHER, DE LUC, GRUNER, and, greatest of all, DE SAUSSURE. There is a useful bibliography."

Bencker, H. The bathymetric soundings of the oceans. *The Hydrographic review*, 7, 64-97, 1930. ISIS

Contains chronological list of ocean explorations from the year 1800.

Bertacchi, Cosimo. Geografi ed esploratori italiani contemporanei. Milan, AGOSTINI, 1929. ISIS

Biasutti, Renato. Lo sviluppo della cartografia dell'Italia nei secoli XIV-XVII. *L'Universo*, 11, 549-557, 1930. ISIS

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The length of the old English mile, deduced from measurements on maps dated from 1300 to 1895, varies between 0.92 and 1.35 of the present statute mile.

C. W. A.

Curnow, I. J. The world mapped : being a short history of attempts to map the world from antiquity to the twentieth century. vi+104 p., 10 pl. London, SIFTON PRAED, 1930. ISIS

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Donazzolo, Pietro. I viaggiatori Veneti minori : studio bio-bibliografico. 412 p. Rome, *Memorie della R. Soc. Geogr. Ital.*, 16, 1929. ISIS

Reviewed by G. R. C., *Geographical Journal*, 76, 82, London, 1930. "References to the manuscript and printed sources for nearly 400 Venetian travellers. The compiler quotes the directions of the 'Council of Ten' to intending travellers, extending to details such as the temperature, density of population, ancient and modern topographical names, and particularly the lineage and state of the ruler. The list includes such names as GIOSAFAT BARBARO, ALVISE DA MOSTO, and ANTIONIO PIGAFETTA."

Elder, John Rawson. The pioneer explorers of New Zealand. London, 1929. ISIS

Friederici, Georg. Der Grad der Durchdringbarkeit Nordamerikas im Zeitalter der Entdeckungen und ersten Durchforschung des Kontinents durch die Europäer. *Petermanns Mitteilungen*, Nr. 209, 1930. ISIS

Ganong, W. F. Crucial maps in the early cartography and place-nomenclature of the Atlantic Coast of Canada. 14 figs. *The Royal society of Canada, Transactions*, Section II, 3rd series, 23, 135-75, 1929. ISIS

(Geographical Congress, International). International geographical congress, Cambridge, 1928. Report of the proceedings. Cambridge, 1930. ISIS

Helbronner, P. Histoire sommaire de la représentation cartographique de la Corse. *Revue générale des sciences*, 41, 509-18, 1930 ; 42, 335-43, 1931. ISIS

Karpinski, Louis C. The evolution of the map of the world : Errors in early maps lead to the discovery of America (*The Dearborn Independent*, May 31, 1924) ; How the Great Lakes were placed on the map *ibid.*, July, 19, 1924) ; Mapping out America : How the Mayflower's arrival was anticipated (*ibid.*, March 7, 1925) ; Mapping the Mississippi Valley (*ibid.*, May 2, 1925) ; Mapping the Great Northwest : Fake records made by unscrupulous cartographers claiming new lands (*ibid.*, August 1, 1925) ; Mapping the Northwest Passage : How hundreds of brave souls succumbed to the lure of pathfinding (*ibid.*, August 8, 1925). ISIS

Merian, Matthaeus. Topographia provinciarum Austriacarum, Austriae,

Styriae, Carinthiae, Carniolae, Tyrolis etc. Frankfurt a. M., Frankfurter Kunstverein, 1929. ISIS

Reviewed in *Geog. Anzeiger*, 31, 175, 1930.

Mill, Hugh Robert. The record of the Royal Geographical Society, 1830-1930. Published at the celebration of the Society's centenary, October, 1930. London, Royal Geographical Society, 1930. ISIS

Moerman, H. J. Seylsteen en kompas. *Tijdschrift van het Koninklijk Nederlandsch aardrijkskundig genootschap*, 48, 200-20, 1931. ISIS

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Mühlberger, Josef. Die Entwicklung der österreichischen Staatskartographie. *Mitteilungen des Reichsamts für Landesaufnahme*, 5, 193-213, 1929/30. ISIS

Naber, Samuel Pierre L'Honoré. Reisebeschreibungen von Deutschen Beamten und Kriegsleuten im Dienst der Niederländischen West- und Ost-Indischen Kompagnien 1602-1797, hrsg. von S. P. L'Honoré Naber. The Hague, Nijhoff, 1930. ISIS

Nordholm, Gösta. Skånes geometriska kartlaggning före storskiftena. *Svensk geografisk årsbok*, 104-30, 1929. ISIS

French résumé : Les cartes géométriques de la Scanie d'avant le grand partage, 127-30.

Olszewicz, Boleslaw. Kartografja Polska XV i XVI wieku. (Przeglad chronologiczno-bibljograficzny). *Polski przeglad kartograficzny*, 8, 147-68, 1930. ISIS

French résumé : La cartographie polonaise du XV^e^ et XVI^e^ siècles. Revue chronologique et bibliographique, 167-68.

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French résumé : Contribution à la question du Triton et de la Tritonis libyques, 162-64.

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Reference in : *Rivista geografica italiana*, 36, 182, 1929.

Scott, Ernest. Australian discovery. Vol. I, By sea ; vol. 2, By land. 2 vols. ills., maps. London, DENT, 1929. ISIS

Reviewed in *Geographical Journal*, 75, 189, 1930.

Sharp, Henry A. An historical catalogue of Surrey maps. Croydon, 1929. ISIS

Sindik, I. Physiogeographische Elemente auf den alten Karten der südslavischen Länder. *Bulletin de la Société de géographie de Beograd*, 16, 122-39, 1930. ISIS

Text in Serbian with German summary.

Smith, Clara A. The Newberry Library. List of manuscript maps in the EDWARD E. AYER collection. Compiled by CLARA A. SMITH. Chicago, 1927. ISIS

Steffen, Hans. Los fundamentos histórico-geográficos de la leyenda de " Los Césares." *Revista chilena de historia y geografia*, 65, 101-23, 1930. ISIS

Thorade, Hermann. Ebbe und Flut in der Nordsee ; ein geschichtlicher Rückblick. *Petermanns Mitteilungen*, EH. 209, 195-206, 1930. ISIS

Thorington, J. Monroe. The Oetzthal glaciers in history and cartography before 1800. *Geographical Journal*, 75, 233-41, London, 1930. ISIS

Wagner, Hermann. HERMANN WAGNER Gedächtnisschrift : Ergebnisse und Aufgaben geographischer Forschung. 391 p., maps, illus. *Petermanns Mitt.*, Ergänzungsheft no. 209, 1930. ISIS

Reviewed in *Geographical Review*, 349-51, 1931.

32. — GEOLOGY, MINERALOGY, PALAEONTOLOGY, MINING

(For Palaeobotany, Palaeozoology and Palaeoanthropology, see respectively, 28. *Botany*, 29. *Zoology, and* 39. *Prehistory)*

Davison, Charles. The Japanese earthquake of 1923. XII+127 p., 6 pl. London, MURBY, 1931. ISIS

Gsell, Stéphane. Vieilles exploitations minières dans l'Afrique du Nord. *Hespéris*, 8, 1-21, 1928. ISIS

Leith, C. K. World minerals and world politics : a factual study of minerals in their political and international relations. XII+213 p. New York, Whittlesey House, 1931. ISIS

Reviewed by A. C. VEATCH, *Geographical Review*, 334-36, 1931.

Rickard, T. A. Copper mining in Cyprus. Paper of the Institution of Mining and Metallurgy, London, discussed on Thursday, March 20th, 1930. 17 p., 6 figs. ISIS

" We have not sufficient evidence to permit us to say what kind of ore the Romans worked or how they smelted it, but it is probable that the copper that gave prehistoric fame to Cyprus was native metal, because it was purer than the metal to be derived from the crude smelting even of oxidized ore. The presence of native sulphur indicates that the deposits of cupriferous pyrite underwent the chemical reactions, incidental to weathering, that would yield native copper. This inference is confirmed by a remark made by CONSTANTINUS, Archbishop of Sinai, who visited Cyprus in 1766. ' There is found buried,' he says, ' that fine copper which nature has cleansed, preparing it beforehand for man's handicrafts. This was the copper first known to, and first found in, the world, and especially sought after by the ancients.' The use of native copper is characteristic of the beginning of every primitive metal culture."

Smith, W. Campbell. A remarkable septarium from South Wales. *Natural History Magazine*, 2, 262-26, London, 1930. ISIS

Historical notes on attempted explanations of septaria from PARACELSUS to the present day.

C. W. A.

33. — METEOROLOGY, CLIMATOLOGY, AND TERRESTRIAL PHYSICS

Miller, Eric R. The evolution of the meteorological institutions in the United States. *Monthly Weather Review*, 59, 1-6, Washington, D.C., 1931. ISIS

" The object of this paper is to outline the stages in the growth of the organizations that have dealt with climate and weather in the United States of America and to present a chronological bibliography."

VI. ANTHROPOLOGICAL AND HISTORICAL SCIENCES

(Knowledge of man, past and present)

35. — PHYSICAL ANTHROPOLOGY

(Anthropometry and races of man)

Bonar, James. Theories of population from RALEIGH to ARTHUR YOUNG:

Lectures delivered in the Galtonian laboratory, University of London, under the Newmarch Foundation, February 11 to March 18, 1929, with two additional lectures and with references to authorities. 253 p. London, ALLEN and UNWIN, 1931. ISIS

Keith, Sir Arthur. New discoveries relating to the antiquity of man. 512 p. London, WILLIAMS and NORGATE, 1931. ISIS

Reviewed by G. ELLIOT SMITH, *Nature*, 127, 963-67, 1931.

Serboianu, Popp. Les Tsiganes. 400 p., pl. Paris, PAYOT, 1930. ISIS

Reviewed by V. A., *Revue générale des sciences*, 42, 92, 1931.

Smith, G. Elliot. The significance of the Peking man. 20 p., 6 pl. (The Henderson Trust lectures, no. 11, delivered at the University of Edinburgh, Friday, 30th January, 1931). London, OLIVER and BOYD, 1931. ISIS

36. — PHYSIOLOGY

(Human and comparative)

Fulton, John F. Selected readings in the history of physiology. XX+317 p., frontispiece, 60 fig. Springfield, Ill., CHARLES C. THOMAS, 1930. ISIS

Reviewed by S. V. LARKEY, *Isis*, 15, 386-88, 1931.

Henderson, L. J. Le sang, système physico-chimique. Traduit de l'anglais par C. VAN CAULAERT et A. ROCHE. Préface de M. D'OCAGNE et LEON BLUM. VIII+298 p. Paris, Presses Universitaire de France, 1931. ISIS

Koopman, J. Bijdragen tot de geschiedenis der endocrinologie. *Bijdragen tot de geschiedenis der geneeskunde*, 11, 169-73, 1931. ISIS

37. — PSYCHOLOGY

(Human and comparative)

Burks, Barbara Stoddard; Jensen, Dortha Williams; Terman, Lewis M. Genetic studies of genius. Vol. 3: The promise of youth: follow-up studies of a thousand gifted children. Assisted by ALICE M. LEAHY, HELEN MARSHALL, MELITA H. ODEN. XIV+508 p. Stanford University, Cal., 1930. ISIS

Reviewed by KARL PEARSON, *Nature*, 127, 772-74, 1931.

Fearing, Franklin. Reflex action. A study in the history of physiological psychology. XIII+350 p. Baltimore, WILLIAMS & WILKINS, 1930. ISIS

Reviewed by B. F. SKINNER and W. J. CROZIER, *Journal of General Psychology*, 5, 125-29, 1931.

Lange-Eichbaum, Wilhelm. Das Genie-Problem. Eine Einführung. 125 p. München, REINHARDT, 1931. ISIS

Reviewed by W. ENKE, *DLZ*, 2, 856-58, 1931.

Segond, J. Traité de psychologie. 502 p. Paris, COLIN, 1930. (45 fr.) ISIS

Bien que, dès le principe (p. 2), l'auteur envisage la vie spirituelle comme fondée en celle du corps, le point de vue physiologique est très loin de dominer la position qu'il prend vis-à-vis de la psychologie dont il voit le problème central dans celui de la génération des valeurs spirituelles. Le problème à l'analyse duquel il semble surtout s'employer est celui de la croyance, dont il forme le rapport à celui de la perception, à celui de la volonté et à celui du moi.

L. G.

Segond, J. Le problème du génie. 283 p. *(Bibliothèque de philosophie scientifique)*. Paris, FLAMMARION, 1930. ISIS

Reviewed by MARCEL FRANÇOIS, *Revue générale des sciences*, 42, 287, 1931.

Wallon, Henri. Principes de psychologie appliquée. 224 p. *(Collection Armand Colin)*. COLIN, Paris, 1930. ISIS

Aucune discussion sur ce qui différencie la psychologie appliquée de la psychologie qui se dit théorique, rationnelle ou qui se fonde simplement sur l'introspection. Mais des faits, qui commandent l'ordonnance de l'ouvrage. Un acte est en expectative; ses possibilités sont d'ordre général : psychologie du travail, ou spécial: s'il s'agit d'aptitudes particulières et individuelles : méthode des tests. Mais l'organisation du travail suppose une exacte adaptation des moyens aux fins : rationalisation des méthodes, de l'outillage, chaque individu étant choisi pour chaque tâche selon ses aptitudes : sélection professionnelle, et recevant la tâche qui lui convient le mieux : orientation professionnelle. L'acte en expectative exige aussi le consentement du sujet : la réclame peut entraîner ce consentement. Enfin, l'acte accompli exerce encore une action en retour sur son auteur; la justice s'en est avisée et elle a mis à l'étude non seulement la critique des témoignages, mais encore les modifications d'attitudes et de réactions que peut entraîner le fait de s'être rendu coupable ou d'avoir été complice d'un crime.

L. G.

38. — ARCHAEOLOGY

(Generalities, methods)

Codice Troano. Hecho por Matev. 70 p. Faksimile-Text ; 8 p. Übertragung in Spanisch, Deutsch, Englisch und Französisch. Madrid, Artes e Industrias Gráficas, 1930. ISIS

Reviewed by HERMANN BEYER, *DLZ*, 2, 660-62, 1931.

Dingwall, Eric John. The girdle of chastity : a medico-historical study. x+171 p., 10 pl. London, ROUTLEDGE, 1931. ISIS

Frobenius, L. Erythrãa. Berlin, Atlantis-Verlag, 1931. ISIS

Genet, Jean. Histoire des peuples Mayas-Quichés (Mexique, Guatémala, Honduras.) 256 p. Paris, GENET, 1927. ISIS

Reviewed by L. E. E., *Geographical Journal*, 76, 358-59, London, 1930.

Genet, Jean. Histoire des peuples Shoshones-Aztèques (Amérique du Nord et Amérique Centrale.) 352 p. Paris, GENET, 1929. ISIS

Reviewed by L. E. E., *Geographical Journal*, 76, 358, 1930. Includes succinct accounts of the religions of the different groups in their primitive condition. A useful bibliography is added.

C. W. A.

Giesecke, Walther. Italia numismatica. Eine Geschichte der italischen Geldsysteme bis zur Kaiserzeit. VII+373 p., 24 pl. Leipzig, HIERSEMANN, 1928. ISIS

Reviewed by WILLY SCHWABACHER, *DLZ*, 2, 1029-33, 1931.

Gordon, F. G. Through Basque to Minoan : transliterations and translations of the Minoan tablets. 83 p. Oxford, University Press, 1931. ISIS

Grenier, Albert. La tradition de l'archéologie gallo-romaine. *R. des cours et conférences*, 32, 28-43, 97-113, 1930-31. ISIS

Deux premières leçons d'un cours professé à l'Université de Strasbourg. Leur ensemble paraîtra, avec documentation, en tête du *Manuel d'archéologie gallo-romaine*, continuation du Manuel de DÉCHELETTE, chez A. PICARD, Paris.

L. G.

Magoffin, Ralph van Deman. The lure and lore of archaeology. London, BAILLIÈRE, TINDALL and COX, 1931. ISIS

Means, Philip Ainsworth. Peruvian textiles. Examples of the pre-

Incaic period. With a chronology of early Peruvian cultures. Introduction by JOSEPH BRECK. 27 p., 24 pl. New York, Metropolitan Museum of Art, 1931. ISIS

Moorehead, Warren King. Archaeology of the Arkansas River Valley. With supplementary papers on the prehistoric cultures of Oklahoma, by Joseph B. THOBURN, and the exploration of Jacobs Cavern, by CHARLES PEABODY. x+205 p. (Published for the Department of Archaeology, Phillips Academy, Andover, Massachusetts.) New Haven, Yale University Press, 1931. ISIS

Petrie, W. M. Flinders. An old world cubit in America. *Ancient Egypt*, 98-99, 1922. ISIS

Apropos of archaeological excavations in the Chaco Canyon, New Mexico. Conclusion: "Now from these it seems clear that the unit is about 20-68 inches by the most accurate measures. In the circle at Aztec it appears that the inside of the benches and the outer wall are the simple numbers of design (24, 25, 40), and the intermediate numbers result from 7, 3, 3 and 2 cubits for chambers and walls. This accords exactly to the well-known Egyptian cubit: 20-62 in the best early example, 20-65 in later cubit rods, 20-76 on the Roman Nilometers. Babylonia had a rather longer form, 20-88 for the cubit of Gudea's plotting scales, carved on the drawing-board that rests upon his knees in the Louvre statues. This was also the standard of Asia Minor, 20-6 to 20-9, mean of all 20-63. How could this reach New Mexico? It was evidently Asiatic. We have evidence from weights of an Asiatic diffusion of a Babylonian original over India, China and Etruria. If the cubit similarly passed to China, it might thence reach North America. It has been already pointed out in this Journal (1916, p. 108) how the cross at Palenque (Southern Mexico) was in its detail of ornament derived from Italian crosses of about the eighth century, probably carried to China by the Nestorian mission. By the same route the Asiatic cubit may have passed over to the New World at some earlier period."

Schrötter, Friedrich v. Wörterbuch der Münzkunde. In Verbindung mit N. BAUER, K. REGLING, A. SUHLE, R. VASMER und J. WILCKE hrsg. von FRIEDRICH V. SCHRÖTTER. XVI+777 p., 28 pl. Berlin, DE GRUYTER, 1930. ISIS

Reviewed by WILLY SCHWABACHER, *DLZ*, 2, 847-50, 1931.

Woolley, C. Leonard. Digging up the past. London, METHUEN, 1931. ISIS

39. — PREHISTORY

Artelt, Walter. Keltische Leichenzerstückelung nach neuen Funden. *Die Medizinische Welt*, 5, 8 p., 4 fig., 1931. ISIS

Cauvet, G. Les Berbères en Amérique : Essai d'ethnocinésie préhistorique : nomenclature et examen des tribus homonymes des deux rives de l'Atlantique. Part des Berbères dans le peuplement de l'Amérique. 455 p. Alger, BRINGAU, 1930. ISIS

In supposed resemblances between certain American Indian tribal names and similar names in North Africa and elsewhere in the Old World, the author sees evidence, which he deems convincing, of many westward migrations of peoples across the Atlantic in pre-Columbian times. He dallies with the idea that the lost Atlantis may have been a stopping place of these migrants.
J. K. W.

Marples, E. A. The copper axe. *Ancient Egypt*, 97-100, 1929. ISIS

"The axe, the foremost of implements, is the only document of the past which has preserved an unbroken connection between the vastly remote world of early man and the living world of the present day : whether as a tool or weapon, a form of currency, a standard of weight, or a symbol of authority, the axe is never wholly absent from man's equipment. The stone hand axe belongs to a timeless age of which the periods are marked by the slowly changing face of the axe itself. The copper axe, by comparison, is modern, and appears only when the province of predatory man has already been invaded by man the producer. Tillage, with implements of wood and stone, brought civic life to a savage and nomadic world; copper implements brought craftsmanship into the world, and placed in the scales of commerce a wealth of chattels in exchange for the products of agriculture."

Menghin, Oswald. Weltgeschichte der Steinzeit. XVI+648 p. Wien, SCHROLL, 1931. ISIS

Reviewed by M. C. BURKITT, *Nature*, 127, 843-45, 1931.

Peake, H. ; Fleure, H. J. The corridors of time, VI. The way of the sea. VIII+168 p. Oxford, Clarendon Press, 1929. ISIS

From the building of the second city of Troy, about 2400 B.C., to the opening of the Hyksos period in Egypt, about 1660 B.C. C. W. A.

Sprockhoff, Ernst. Zur Handelsgeschichte der germanischen Bronzezeit. XII+161 p., 45 pl. (*Vorgeschtl. Forschgn.* Begr. v. MAX EBERT. In Verbindg. m. G. KARO u. H. OBERMAIER hrsg. v. E. SPROCKHOFF. H. 7.) Berlin, DE GRUYTER, 1930. ISIS

Reviewed by K. H. JACOB-FRIESEN, *DLZ*, 2, 1130-33, 1931.

40. — ETHNOLOGY

(Primitive and popular science)

Aldrich, C. R. The primitive mind and modern civilization. London, KEGAN PAUL, 1931. ISIS

Bargheer, Ernst. Eingeweide. Lebens- und Seelenkräfte des Leibesinnern im deutschen Glauben und Brauch. xv+443 p., 8 fig., 8 pl. Berlin, DE GRUYTER, 1931. ISIS

Bryk, Felix. Die Beschneidung bei Mann und Weib : ihre Geschichte, Psychologie und Ethnologie. x+319 p. (*Monographien zur Ethno-Psychologie*, hrsg. v. F. BRYK und C. L. HANSEN, Bd. 1.) Neubrandenburg, FELLER, 1931. ISIS

Caton-Thompson, G. The Zimbabwe culture : ruins and reactions. xxiv+299 p., 74 pl. Oxford, Clarendon Press, 1931. ISIS

Reviewed by C. W. H., *Nature*, 127, 884-86, 1931.

Delaunay, P. La médecine populaire, ses origines magiques, religieuses, dogmatiques et empiriques. 79 p., ills., (Extrait de la *Médecine internationale illustrée.*) Tours, 1930. ISIS

Reviewed by MARCEL FOSSEYEUX, *Bulletin de la société française d'histoire de la médecine*, 25, 617, 1931.

Dexter, T. F. G. Fire worship in Britain. 48 p. London, WATTS, 1931. ISIS

Frazer, Sir James George. Garnered sheaves. Essays, addresses, and reviews. 509 p. London, MACMILLAN, 1931. ISIS

Freudenthal, Herbert. Das Feuer im deutschen Glauben und Brauch. xx+571 p., 15 fig., 11 pl. Berlin, DE GRUYTER, 1931. ISIS

Heydrich, M. *Ethnologischer Anzeiger* : Jahresbibliographie und Bericht über die völkerkundliche Literatur. Hrsg. v. M. HEYDRICH. Bd. 2, Heft 4. p. 129-200. Stuttgart, SCHWEIZERBART, 1930. ISIS

Reviewed in *Nature*, 127, 700, 1931.

Huet, Gédéon. Les contes populaires. 192 p. (*Bibliothèque de culture générale*). Paris, FLAMMARION, 1923. ISIS

Ce petit livre excellent aurait dû être signalé depuis longtemps à nos lecteurs. L'auteur, qui avait lu et comparé les contes de tous les pays, nous y donne les conclusions de ses longues études en trois chapitres : 1. le problème des contes populaires; 2. leur évolution et formation; 3. leur influence sur la littérature. Élève de GASTON PARIS et PAUL MEYER, il était bibliothécaire à la Bibliothèque nationale; il mourut pendant l'impression de son livre.

G. S.

Ivens, Walter G. The island builders of the Pacific. How and why

the people of Mala construct their artificial islands, the antiquity and doubtful origin of the practice, with a description of the social organization, magic and religion of their inhabitants. 317 p., fig., map. London, SEELEY, SERVICE, 1930. ISIS

Reviewed by KARL SAPPER, *DLZ*, 2, 517-19, 1931.

Lehmann, F. Rudolf. Die polynesischen Tabusitten. Eine ethnosoziologische und religionswissenschaftl. Untersuchung. VII+344 p. (*Veröff. des Staatl.-sächs. Forschungsinstituts für Völkerkunde* in Leipzig, hrsg. von. O. RECHE. 1. Reihe : Ethnographie und Ethnologie, 10. Bd.) Leipzig, VOIGTLÄNDER, 1930. ISIS

Reviewed by ALFRED MAASS, *OLZ*, 34, 588, 1931.

Lejeune, Fritz. Die Zahnheilkunde bei den Urkulturvölkern. *Die Fortschritte der Zahnheilkunde*, 6, 1087-98, 1930. ISIS

Marett, R. R. ; Penniman, T. K. SPENCER's last journey : being the journal of an expedition to Tierra del Fuego by the late Sir BALDWIN SPENCER ; with a memoir. With contributions by Sir JAMES FRAZER and H. BALFOUR. XII+153 p., 14 pl. Oxford, Clarendon Press, 1931. ISIS

Marinus, Albert. Ethnographie, folklore et sociologie. *Folklore Brabançon*, 10, 23 p., (1930). ISIS

Marinus, Albert. Folklore historique et folklore sociologique. *Annuaire de la Société Luxembourgeoise d'Etudes Linguistiques et Dialectologiques*, 97-104, 1930. ISIS

Marinus, Albert. Le deuxième Congrès international des arts populaires. *Folklore Brabançon*, 10, 9 p. (1930). ISIS

Marinus, Albert. Le néo-folklorisme. ISIDOOR TEIRLINCK album, 231-37, Louvain, 1931. ISIS

Marinus, Albert. Un programme international d'étude des arts populaires. *Folklore Brabançon*, 10, 14 p. (1930). ISIS

Matthäus, Kurt. Alte Volksheilkunst in neuem Lichte. Eine wissenschaftliche Darstellung des volkstümlichen Heilwissens unter Zurückführung auf die zugrunde liegenden Naturgesetze. Unter Mitarb. v. ERICH ZÖBISCH. 191 p., 84 fig., 10 pl. Dresden, EULEX, 1931. ISIS

Ronhaar, J. H. Woman in primitive motherright societies. 541 p. The Hague, WALTERS, 1931. ISIS

Steedman, Elisie Viault. Ethnobotany of the Thompson Indians of British Columbia. Based on field notes by SAMER A. TEIT. *45th annual report of the Bureau of Amer. Ethnology*, p. 441-522. Washington, Smithson. Instit. 1927-28. ISIS

Stow, George William. Rock-paintings in South Africa : from parts of the Eastern Province and Orange Free State. Introduction and descriptive notes by DOROTHEA F. BLEEK. XXVIII+70 p., 72 pl. London, METHUEN, 1930. ISIS

Reviewed by H. BREUIL, *Nature*, 127, 695-98, 1931.

Torday, E. African races (Pygmies, Bantu, Equatorial hybrid tribes, Sudanic peoples, Nilotics, Nilo-Hamitics, Fulani, Khoisan). Compiled and abstracted upon the plan organized by HERBERT SPENCER ; a re-issue of the vol. originally compiled by DAVID DUNCAN, entirely rewritten. Issued by Spencer's Trustees. IX+385 p., 7 pl., 1 map. (*Descriptive sociology or Groups of sociological facts, classified and arranged by* HERBERT SPENCER. Nr. 4, division 1, part 2 A). London, WILLIAMS & NORGATE, 1930. ISIS

Reviewed by DIEDRICH WESTERMANN, *DLZ*, 2, 1327-1329, 1931; by B. MALINOWSKI, *Nature*, 127, 655-57, 1931.

Wright, Jonathan. Medicine of primitive man. XIV. *Medical Life*, 38, 400-450, 1931. ISIS

41. — SUPERSTITION AND OCCULTISM

Budge, Sir E. A. Wallis. Amulets and superstitions : the original texts with translations and descriptions of a long series of Egyptian, Sumerian, Assyrian, Hebrew, Christian, Gnostic and Muslim amulets and talismans and magical figures ; with chapters on the evil eye, the origin of the amulet, the pentagon, the swāstika, the cross (pagan and Christian), the properties of stones, rings, divination, numbers, the ḳabbālāh, ancient astrology, etc. XXXIX+543 p., 22 pl. Oxford, University Press, 1930. ISIS

Caillet, Emile. La prohibition de l'occulte. XII+208 p., Paris, ALCAN, 1930. ISIS

L'auteur pose ainsi nettement le problème auquel il s'est attaché : « les sociétés qui doivent tout à la magie, celle-ci ayant probablement caractérisé

leur enfance, non seulement s'en dégageant, mais souvent, comme c'est le cas pour la nôtre, en viennent à se détourner avec dégoût de l'occulte et à lui manifester une vive hostilité. On a l'impression d'assister, au cours de l'histoire, à une prohibition progressive de l'occulte. De quelles circonstances celle-ci est-elle fonction ? ». Parmi les nombreuses causes qu'il découvre à cette prohibition, il fait une place à part à la « peur du mort », inconsciente chez le civilisé, mais qui fait néanmoins passer chez lui « ce même frisson d'horreur dont est secoué le non civilisé que la voix nasillarde appelle dans le voisinage du tombeau ».

L. G.

Georg, Eugen. The adventure of mankind. Translated from the German by ROBERT BEK-GRAN. VIII+325 p. New York, DUTTON, 1931. ISIS

The author marshals the myths of the period of pre-history, and the cosmogonies of ancient and of primitive peoples in support of the reality of the lost continents of Lemuria and Atlantis in accordance with HÖRBIGER's world-glacial and lunar cataclysmic theory. He also reviews the various myths of beast-men and the legends of sodomitic orgies with a consideration of their historical significance.

C. A. K.

Klinckowstroem, Carl Graf **v.; Maltzahn, Rudolf** Freiherr **v.** Handbuch der Wünschelrute ; Geschichte, Wissenschaft, Anwendung. 321 p., ills. München, OLDENBOURG, 1931. ISIS

This interesting and curious book pertains rather to the history of magic and superstition than to the history of science. The first part, 87 p., by Graf v. KLINCKOWSTROEM, deals with the history of the divining rod. It is illustrated with old pictures and is followed by an elaborate five page bibliography of the subject. The rest of the book, by Freiherr v. MALTZAHN, deals with the science and application of the divining rod. It has many illustrations, diagrams, maps, and pictures of interest to the engineer—and reports modern instances. The authors believe that the divining rod works because of certain physico-physiological reflex processes in the human organism, and consider that it has valuable applications in the work of geologists, hydrographers, and mining and hydraulic engineers.

T. L. D.

Oesterreich, Traugott Konstantin. Possession, demoniacal and other, among primitive races, in Antiquity, the Middle Ages, and modern times. Authorized translation by D. IBBERSON, XI+400 p. London, KEGAN PAUL, 1930. ISIS

Power, Sir **D'Arcy.** Touchpieces and the cure of the king's evil. *Annals of Medical History*, 3, 127-33, 5 fig., 1931. ISIS

Remy, Nicolas. Demonolatry. In three books. Translated by

E. A. ASHWIN. Edited, with introduction and notes by MONTAGUE SUMMERS. XLIII+188 p. London, RODKER, 1931. ISIS

Róheim, Géza. Animism, magic and the divine king. XVIII+390 p. London, KEGAN PAUL, 1930. ISIS

Smith, Catharine Cook. In defence of magic. The meaning and use of symbol and rite. 159 p. London, RIDER, 1931. ISIS

42. — ECONOMICS

(Economic doctrines and history. Commerce. Transportation and communications)

Gray, Alexander. The development of economic doctrine. An introductory survey. 384 p. London, LONGMANS, 1931. ISIS

43. — SOCIOLOGY, JURISPRUDENCE AND POSITIVE POLITY

Ross, Alf. Theorie der Rechtsquellen. Ein Beitrag zur Theorie des positiven Rechts auf Grundlage dogmenhistorischer Untersuchungen. XIV+458 p. (*Wiener Staats- u. Rechtswissenschftl. Studien*, Bd. 13.) Leipzig, DEUTICKE, 1929. ISIS

Reviewed by ERIK WOLF, *DLZ*, 2, 902-04, 1931.

Simons, Walter. The evolution of international public law in Europe since GROTIUS. 146 p. New Haven, Yale University Press, 1931. ISIS

44. — HISTORY OF CIVILIZATION

(General history, historical methods, biography and chronology)

Coulbeaux, J. B. Histoire politique et religieuse d'Abyssinie. Depuis les temps les plus reculés jusqu'ä l'avènement de MÉNÉLICK II. Tome I-III. XXVII+356 p.; 493 p.; 220 fig., 6 maps. Paris, GEUTHNER, 1929. ISIS

Reviewed by J. LIPPL, *DLZ*, 2, 683-86, 1931.

Jullian, Camille. Au seuil de notre histoire. 2 vol. 253+292 p., Paris, BOIVIN et Cie, 1930, 1931. (20 fr. le vol.) ISIS

Vol. I. Leçons d'ouverture au Collège de France de 1905 à 1913. Série d'études sur l'installation et la vie des « premiers hommes de France » sur le sol de France. Évocation de l'existence de nos ancêtres des cavernes; reconstitution des groupements sociaux d'alors et étude de ce que cet autrefois

a laissé de soi dans les ruines, car « parler du passé sans étudier le sol qui a nourri les hommes, et les pierres qu'ils y ont dressées, c'est proprement déraciner notre histoire ».

Vol. II. Leçons d'ouverture au Collège de France de 1914 à 1923. L'auteur s'est efforcé de montrer les liens qui existent entre les faits contemporains et ceux de toute l'histoire de France. Il fait le procès des empires, édifices de despotisme, mais de fragilité parce que bâtis sur « le mensonge et l'orgueil d'un homme » et parce que créés par cet « esprit de conquête qui a fait trop de mal et dont le monde souffre depuis vingt-cinq siècles ». Pour lui le véritable internationalisme consiste dans celui du cœur, dans la fraternité humaine, et « l'idéal de toute patrie doit être l'espérance d'une humanité plus unie ».

L. S.

45. — HISTORY OF ART

(Art and science. Iconography. Arts and crafts)

Evans, Joan. Pattern. A study of ornament in western Europe from 1180 to 1900. In two volumes. Vol. I., XXXVI+179 p., 250 pl. Vol. II., XV+249 p., pl. 253-435. Oxford, Clarendon Press, 1931. ISIS

Morris, Ernest. The history and art of change ringing. With a foreword by G. F. COLERIDGE. XVIII+673 p. London, CHAPMAN and HALL, 1931. ISIS

Réau, Louis. Dictionnaire d'art et d'archéologie. VIII+487 p., 656 ill., 16 pl. Paris, LAROUSSE, 1930. ISIS

Reviewed by H. LEMONNIER, *Journal des savants*, 136, 1931.

Warthin, Aldred Scott. The physician of the dance of death. Part V. *Annals of Medical History*, 3, 134-65, 26 fig., 1931. ISIS

46. — HISTORY OF LANGUAGE, WRITING AND LITERATURE

Pedersen, Holger. Linguistic science in the nineteenth century. Methods and results. Authorized translation from the Danish by JOHN WEBSTER SPARGO. X+360 p. Cambridge, Harvard University Press, 1931. ISIS

Pizzagalli, A. M. La questione dell'origine degli Indo-Europei e le recenti scoperte della linguistica. *Scientia*, 48, 247-54, 1930. ISIS

Royen, Gerlach. Die nominalen Klassifikations-Systeme in den Sprachen der Erde. Historisch-kritische Studie mit besonderer

Berücksichtigung des Indogermanischen. XVI+1030 p. (*Anthropos.* Linguistische Bibliothek. Internat. Samml. linguistischer Monographien, Bd. IV). Wien, Anthropos, 1929. ISIS

Reviewed by FRANZ SPECHT, *OLZ*, 34, 510-14, 1931.

47. — HISTORY OF MORALS

(Moral organization of Society)

Bayet, Albert. Histoire de la morale en France. Tome I. La morale des Gaulois. XI+288 p., Paris, ALCAN, 1930. (35 fr.) ISIS

Dans ce premier volume d'un important ouvrage qui sera consacré à l'étude de l'histoire de la morale en France, l'auteur étudie successivement : I. La morale des Ligures; II. Totémisme, religion et morale en Gaule; III. Les principes de la morale; IV. La morale et la vie humaine; V. La morale et le corps d'autrui; VI. La morale et les faits d'ordre sexuel; VII. La morale et la propriété; VIII. La morale et la réputation; IX. La morale et la vérité; X. La morale et la famille; XI. La morale et l'organisation sociale; XII. La morale et la vie politique; XIII. Les relations avec l'étranger. La guerre et le droit des gens.

De ces faits étudiés l'auteur conclut que : 1. Il n'y a pas une morale gauloise; la vie morale des Gaulois est riche et diverse, il est vain d'essayer de la définir en quelques formules. 2. Les morales gauloises ne sont pas des morales de « primitifs » ni même de « Barbares ». Il faut combattre l'idée que les Gaulois d'avant la conquête romaine avaient une morale barbare. CÉSAR a tenu à présenter son œuvre comme une victoire de la civilisation sur des sauvages remuants et belliqueux. Loin d'être les demi-barbares que nous montrent certaines légendes, les Gaulois sont arrivés par leur propre effort, à une morale assez analogue à la morale romaine et c'est là ce qui expliquerait la rapidité avec laquelle la Gaule s'est incorporée dans l'empire; il n'y a eu aucune perturbation dans l'éthique.

L. S.

Dombrowski-Ramsay, Nicolas. La morale humaine et la Société des Nations. 124 p. Paris, ALCAN, 1930. ISIS

1. L'éthique dans la vie internationale; 2. La souveraineté et le contrat social; 3. La solidarité internationale et les antagonismes entre nations; 4. La justice sociale; 5. La paix universelle est réalisable; Annexe : le pacte de la Société des Nations.

Sidgwick, Henry. Outlines of the history of ethics : for English readers. With an additional chapter by ALBAN G. WIDGERY. XXVI+342 p. London, MACMILLAN, 1931. ISIS

48. — HISTORY OF PHILOSOPHY

(See also above, 18. Philosophy of science)

Cuvillier, A. Manuel de philosophie à l'usage des classes de philosophie

et de première supérieure. Tome I : Introduction générale. Psychologie. XXXIX+722 p., 90 figs. Paris, COLIN, 1931 (38 frs.). ISIS

Le tome II de ce précieux manuel a paru le premier, — en 1927. Il était consacré à la logique, la morale, et la philosophie générale (*Isis*, 11, 264). Le nouveau volume consacré aux prolégomènes et à la psychologie n'est pas moins remarquable que le précédent par l'ampleur et la richesse de ses vues, et surtout par la clarté. Il constitue une source de documentation rapide et excellente.

G. S.

Lenoir, Raymond. La philosophie de GUSTAVE BELOT. *Revue philosophique*, 55, 86-107, 1930. ISIS

G. BELOT (Strasbourg, 1859-08-8. Paris, 1929-12-22). Étude de morale positive, 1907, deuxième édition 1921. La conscience française et la guerre, 1921. Traduction de la partie intitulée « SOCRATE et les Socratiques » de la Philosophie des Grecs (trad. BOUTROUX, troisième volume 1884). De la logique des sciences morales, de ST. MILL, 1892.

L. G.

Rosny, J. H. Les sciences et le pluralisme. Nouvelle édition. XVI+220 p. de la *Nouvelle collection scientifique* dirigée par EMILE BOREL. Paris, ALCAN, 1930. ISIS

La première édition de ce livre date de 1922, et avait suivi de peu un ouvrage du même auteur « Le pluralisme », 227 p., publié à la même librairie sous le nom de J. H. BOEX-BOREL. L'idée fondamentale est celle de la discontinuité des phénomènes, de l'analogie et non de l'identité des évolutions.

L. G.

Spir, African (1837-1890). Esquisses de philosophie critique. Introduction par LEON BRUNSCHVICG. Nouvelle édition. XVI+168 p. Paris, ALCAN, 1930. ISIS

Réimpression d'un ouvrage paru en 1887 et écrit par SPIR directement en français, alors que les autres travaux de ce philosophe russe sont écrits en allemand. Son ouvrage capital *Denken und Wirklichkeit* a été traduit en français par A. PENJON : *Pensée et réalité*, ALCAN, 1896.

49. — HISTORY OF RELIGION

(Science and religion)

Clemen, Carl. Religions of the world. Their nature and their history. In collaboration with FRANZ BABINGER, LEO BAECK, HEINRICH HACKMANN, F. E. A. KRAUSSE, KARL H. MEYER, FRIEDRICH PFISTER, GÜNTHER ROEDER, ALBERT SCHOTT, FRANZ ROLF SCHROEDER, ERICH SEEBERG, and OTTO STRAUSS. Translated by A. K. DALLAS. XIV+482 p. London, HARRAP, 1931. ISIS

Cohen, Chapman. God and the universe : EDDINGTON, JEANS, HUXLEY and EINSTEIN. With a reply by A. S. EDDINGTON. 133 p. London, Pioneer Press, n.d. ISIS

Reviewed by T. G., *Nature*, 127, 811, 1931.

Descamps, E. Le génie des religions ; les origines, avec un essai liminaire sur la vérité, la certitude, la science et la civilisation. Deuxième éd. revue, corrigée, coordonnée sur un plan nouveau et augmentée d'une étude nouvelle sur l'ethnologie religieuse comparée. XXII+538 p., ALCAN, Paris, 1930. ISIS

Introduction : Vérité, certitude, science, civilisation; 1. La définition liminaire du phénomène religieux; 2. Le fait religieux à la lumière de l'expérience générale; 3. La psychologie générale du phénomène religieux; 4. Les faux points de vue psychologiques concernant la germination naturelle du phénomène religieux dans l'esprit humain; 5. L'ethnologie primordiale du phénomène religieux (mythes et légendes, magie, naturisme, mânisme, totémisme, tabouisme); 6. La sociologie fondamentale du phénomène religieux; 7. Le phénomène religieux examiné en soi à la lumière de la raison; 8. Le phénomène religieux à la lumière des traditions archaïques de l'humanité; 9. Le phénomène religieux à la lumière de l'anthropologie racique; 10. Le phénomène religieux à la lumière de l'archéologie préhistorique; 11. Le phénomène religieux à la lumière de la paléontologie linguistique; 12. Le phénomène religieux à la lumière de l'ethnologie comparée.

Potter, Charles Francis. Les fondateurs de religions. Edition française de G. LEPAGE. VII+425 p. Paris, PAYOT, 1930. ISIS

C. F. POTTER évoque la vie et l'œuvre des grands génies religieux : AKHOUNATON, MOÏSE, ZOROASTRE, le prophète JÉRÉMIE, le BOUDDHA, qui depuis vingt-quatre siècles fait vivre dans sa doctrine de paix des millions d'êtres, CONFUCIUS, JÉSUS, SAINT-PAUL, SAINT-AUGUSTIN, MAHOMET, SAINT THOMAS D'AQUIN, NANAK, le fondateur de la religion shiite, puis LUTHER et le réformateur de l'église russe : NIKONE. Toute grande religion est issue de conceptions religieuses d'un homme supérieur. Pourtant beaucoup de religions n'ont pas dans leur histoire de personnalité marquante; celles-ci présentent des phénomènes identiques à ceux que l'on constate dans les périodes primitives des religions plus développées. Ce sont les religions égyptienne, babylonienne et assyrienne, l'hindouisme, les religions grecque, romaine, scandinave, le shinto, l'ancienne religion mexicaine, auxquelles on peut rattacher les religions primitives de l'Afrique, de l'Amérique et des îles.

L. S.

Reinach, Salomon. Orpheus : a history of religions. Revised and partly rewritten. Translated by FLORENCE SIMMONDS. IX+487 p. London, ROUTLEDGE, 1931. ISIS

Schmidt, W. The origin and growth of religion : facts and theories.

Translated from the original German by H. J. ROSE. XVI+302 p. London, METHUEN, 1931. ISIS

Reviewed in *Nature*, 127, 701, 1931.

Turnbull, Grace H. Tongues of fire. A Bible of sacred scriptures of the pagan world. XXVI+416 p. New York, MACMILLAN, 1929. ISIS

Reviewed by H. LEISEGANG, *OLZ*, 34, 438, 1931.

VII. MEDICINE

50. — HISTORY, ORGANIZATION, AND PHILOSOPHY OF MEDICINE

Artelt, Walter. Arzt und Leibesübungen in Mittelalter und Renaissance. *Klinische Wochenschrift*, 10, 846-49, 1931. ISIS

Barbillion. Etudes critiques d'histoire de la médecine. 239 p. Paris, BAILLIÈRE, 1930. ISIS

Bologa, V. L. Inceputurile medicinii ştiinţifice romaneşti. (Beginnings of Rumanian scientific medicine.) 89 p., 14 fig. Cluj, 1930. ISIS

Bologa, V. L. Institut de l'Histoire de la médecine, de la pharmacie et du folklore médical. *Clujul med.*, 40, 19-20, 1930. ISIS

Brown, Alfred. Old masterpieces in surgery, being a collection of thoughts and observations engendered by a perusal of some of the works of our forbears in surgery. XVIII+263 p. Omaha, Neb., 1928. ISIS

Castiglioni, Arturo. Il contributo degli Italiani alla fisiologia ed alla patologia del cuore. *Nuova Antologia*, 16 p., 1930. ISIS

Clemens, J. R. Notes on English medicine (HENRY VIII-GEORGE IV). *Annals of Medical History*, 3, 308-17, 1931. ISIS

Darmstaedter, Ernst. Zur Geschichte der Narkose und Anästhesie. *Schmerz Narkose Anaesthesie*, H. 3/4, 117-29, 1931. ISIS

Dawson, Bernard. The history of medicine : a short synopsis. XIV+160 p. London, LEWIS, 1931. ISIS

Diepgen, Paul. Einführung in das Studium der Medizin. *Medizinische Welt*, 5, 8 p., 1931. ISIS

Diepgen, Paul. Geschichte der Medizin, I & II. *Archiv für Kulturgeschichte*, 21, 240-56, 357-84, 1931. ISIS

Survey of recent publications on the history of medicine with abundant bibliographical notes and discussion.

Drake, T. G. H. Pap and panada. *Annals of Medical History*, 3, 289-95, 4 fig., 1931. ISIS

Ebstein, Erich. Medical men who experimented upon themselves. A contribution to the causes of death in physicians. *Medical Life*, 38, 216-18, 1931. ISIS

Faber, Knud. Nosography. The evolution of clinical medicine in modern times. Ed. 2, revised. New York, HOEBER, 1930. ISIS

Reviewed by THOMAS MCCRAE, *Annals of Medical History*, 3, 247, 1931. First ed., 1923, reviewed in *Isis*, 6, 98-99, 1924.

Fruchaud. La tradition chirurgicale angevine. *Archives médicales d'Angers*, 34, 181-89, 1930. ISIS

Reviewed in *Bulletin de la société française d'histoire de la médecine*, 25, 211, 1931.

Giordano, Davide. Scritti e discorsi pertinenti alla storia della medicina e ad argomenti diversi. Milan, 1930. ISIS

Reviewed by RAYMOND NEVEU, *Bulletin de la société française d'histoire de la médecine*, 24, 353-54, 1930.

Griaule, Marcel. Le livre de recettes d'un dabtara abyssin. XI+180 p. (Université de Paris : *Travaux et mémoires de l'Institut d'Ethnologie*, tome 12). Paris, Institut d'Ethnologie, 1930. ISIS

Gualino, Lorenzo. Saggi di medicina storica. 399 p., 117 fig. Turin, Minerva Medica, 1930. ISIS

Hamer, Philip M. The centennial history of the Tennessee State Medical Association, 1830-1930. Edited by PHILIP M. HAMER. 580 p. Nashville, Tennessee State Medical Association, 1930. ISIS

Held, Wilhelm. Die Urinschau des Mittelalters und die Harnuntersuchung der Gegenwart. 150 p., 13 fig. Leipzig, KRÜGER, 1931. ISIS

Hintze, Rudolf. Beiträge zur Geschichte der Zahnbürste und anderer Mittel zur Mund- und Zahnpflege. Inaug.-Diss., Berlin, 1930. ISIS

Kausch, Friedrich. Mit Krankheit und Tod durch drei Jahrhunderte. 96 p. Burg b. Magdeburg, Selbstverlag, 1931. ISIS

Koch, Robert. Medicii saşi din secolul al XVIII-lea in oraşele saseşti ale Ardealului. (Sächsische Ärzte im 18. Jhdt. in den sächsischen Städten Siebenbürgens.) 36. p., 4 fig. (Rumänisch). Klausenburger Diss. No. 408, Cluj, 1928. ISIS

(Medicine, history. Eighth International Congress). Le VIII[e] congrès international d'histoire de la médecine (Rome, 22-27 septembre 1930). Compte-rendu des travaux. By MARCEL FOSSEYEUX. *Bulletin de la société française d'histoire de la médecine*, 24, 288-94, 1930. ISIS

Mencke, Stephan. Zur Geschichte der Orthopädie. 160 p. München, BECKSTEIN, 1930. ISIS

Much, Hans. Steht die scholastische Medizin vor einem unvermeidlichen Bankerott? 36 p. (*Moderne Biologie, moderne Medizin*, H. 14). Leipzig, KABITZSCH, 1931. ISIS

Mühlbächer, Fritz. Bedeutende madjarische Ärzte Siebenbürgens im 17.-18. Jahrhundert. 36 p. (Rumänisch). Klausenburger Diss. No. 430, Cluj, 1928. ISIS

Neuburger, Max. Essays in the history of medicine. Translated by various hands and edited, with foreword, by FIELDING H. GARRISON. XVIII+210 p., portr. New York, Medical Life Press, 1930. ($ 5.00). ISIS

The twelve essays published in this volume were translated by a group of admirers of this leader in the scholarly investigation of medical history and published as a belated birthday tribute to him. The essays are : The medical lore of the Bible; Fear of disease; The medicine of the ancient Mexicans; Miscellanies from the history of German neuropathology; The historic past of German neuropathology; The oldest fundamental investigations of the origin of dropsy; ZAMBECCARI, an experimenter of the seventeenth century; THÉOPHILE DE BORDEU, precursor of the doctrine of internal secretions; FERDINAND Edler VON LEBER's services in the abolition of torture in Austria; JOHANN PETER FRANK as founder of the pathology of the spinal cord; SCHILLER's relation to medicine; and LAENNEC. A bibliography of Professor NEUBURGER's writings from 1897 to 1926 includes 139 books and monographs.

C. A. K.

Neuendorff, Edmund. Geschichte der neueren deutschen Leibesübung vom Beginn des 18. Jahrhunderts bis zur Gegenwart. Bd. 1 : Geschichte der deutschen Leibesübung vom Beginn des 18. Jahrhunderts bis zu JAHN. Mit einem Grundriss der Gesch. d. deutschen Leibesübung von den Urzeiten bis zum Beginn des 18. Jahrhunderts. VII+467 p., 26 fig., Dresden, LIMPERT, 1930. ISIS

Pagel, Walter. Ein Gang durch die älteren medizinischen Lehrsysteme. *Med. Welt*, 5, 319-20, 463-65, 1931. ISIS

Pina Guimarães, Luis José de. Vimaranes, materias para a História da medicina Portuguesa. Arqueologia. Antropologia. Historia. 336 p., 66 fig. Porto, ARAÚJO & SOBRINHO, 1929. ISIS

Putti, Vittorio. Historic artificial limbs. 63 p., 11 fig. New York, HOEBER, 1930. ISIS

Robinson, Victor. Specimen questions and answers from the lectures of VICTOR ROBINSON, M. D., Professor of the History of Medicine, Temple University School of Medicine. 2nd ed. 32 p. Philadelphia, 1931. ISIS

This is a quiz-compend for about forty high points in the history of the healing art from the primitive medicine man to BEAUMONT, PASTEUR, and FINSEN. The data are largely assembled as the leading contributions of investigators selected for their eminence.

C. A. K.

Rolants, E. Notes sur l'histoire médicale de Lille et de sa région ; la désinfection à Lille pendant l'épidémie de choléra de 1832 ; les bains à Lille ; les blessés de Fontenoy soignés à Lille. 40 p. Lille, Imprimerie centrale, 1930. ISIS

Reviewed in *Bulletin de la société française d'histoire de la médecine*, 25, 214-15, 1931.

Sigerist, Henry E. Einführung in die Medizin. VI+405 p. Leipzig, THIEME, 1931. ISIS

Sigerist, Henry E. Psychopathologie und Kulturwissenschaft. *Abhandlungen aus der Neurologie, Psychiatrie, Psychologie und ihren Grenzgebieten*, H. 61, 140-46, Berlin, 1930. ISIS

Sigerist, H. E. Vom Hippokratischen Eid zur deutschen ärztlichen Standesordnung. *Deutsches Ärzteblatt*, 7 p., 1931. ISIS

Sigerist, Henry E. Wandlungen des Arztideals. *Soziale Medizin*, 3 p., 1930. ISIS

Stubbs, S. G. Blaxland ; Bligh, E. W. Sixty centuries of health and physic. The progress of ideas from primitive magic to modern medicine. Introduction by Sir HUMPHRY ROLLESTON. XVI+253 p., 64 pl. London, SAMPSON, LOW, MARSTON, 1931. ISIS

Szumowski, W. Die Geschichte der sog. "ziemskaja medicina", der medizinischen Organisation im "Semstwo"system Russlands 1864-1914. 95 p. Warsaw, GEBETHNER i WOLFF, 1919. (Polish). ISIS

Reviewed by BILIKIEWICZ, *Mitteilungen zur Geschichte der Medizin und der Naturwissenschaften*, 30, 112, 1931.

Thiel, Rudolf. Männer gegen Tod und Teufel. Aus dem Leben grosser Ärzte. 416 p., 17 fig. Berlin, NEFF, 1931. ISIS

Tyler, Albert E. ; Auerbach, Ella F. History of medicine in Nebraska. Omaha, Magic City Printing Co., 1928. ISIS

Reviewed in *Annals of Medical History*, 3, 357, 1931.

Wehrli, G. A. Die Wundärzte und Bader Zürichs als zünftige Organisation. Geschichte der Gesellschaft "Zum Schwarzen Garten". 132 p., 105 fig. (*Mitt. d. Antiquar. Ges. in Zürich*, Bd. 30, H. 8). Zürich, Antiquar. Gesellschaft, 1931. ISIS

Zeiss, Heinz. Der Arbeitsplan des neugegründeten Moskauer Forschungsinstituts für Geschichte und Methodologie der Medizin. *Archiv f. Geschichte der Medizin*, 24, 258-63, 1931. ISIS

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The book is written in a terse, almost telegraphic, style and is a compendium of the basic facts of medical history largely assembled on the biographical pattern. The five chapters treat of: Prehistoric man to HIPPOCRATES; Arabic medicine, the mediaeval period, and the Rennaissance; the 17th and 18th centuries; the 19th century; and the 20th century. There is a bibliography of 164 titles and an index of names.

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R. C. Archibald *(Providence)*
A. Birkenmajer *(Krakau)*
M. Bigelow *(Cambridge, Mass.)*
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